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OUR TWO BRAINS.

By RICHARD A. PROCTOR.

SUGGESTIONS FOR THE PRACTICAL APPLICATION OF THE THEORY.

(*Continued from p.* 194.)

THE next point cited by Dr. Brown-Sequard does not seem quite so clearly favourable to his views; in fact, it appears to me to *suggest* a rather strong argument against the hope which he entertains that the general mental powers may be improved by exercising both sides of the brain in the same kind of work. He points out that very few left-handed persons have learned to write with the left hand, and that those who can write with that hand do not write nearly so well with it as with the right hand. "Therefore," he says, "the left side of the brain, even in persons who are left-handed naturally (so that the right side of the brain controls the reasoning faculties and their expression) can be so educated that the right hand, which that side of the brain controls, produces a better hand-writing than that by the left hand, though this is controlled by the better developed brain." This certainly seems to show the possibility of training one side of the brain to do a part of the work appertaining in the ordinary course of things to the other; but the inferiority of the writing with the left hand is rather an awkward result so far as Brown-Sequard's hopes are concerned. For it looks very much as though the habit of writing with the right hand, which in the case of a left-handed person is in fact the wrong hand for writing with, rendered the right brain less fit to control that special department of its duties (for a left-handed person) which relates to the expression of ideas by writing. Now it may be a very useful thing to acquire true duality of brain-power, if the ordinarily less-used side of the brain, for any particular action, does not acquire full power for that function at the expense of the other side; but otherwise the advantage is not so obvious. If we could train the left arm to be as skilful as the right, without losing the skill of the right arm, we should willingly take the proper measures; but merely to shift the skill from one arm to the other would lead to no advantage, even if we could be quite sure that it would involve no loss. And, as I have said, this particular argument suggests a test which can hardly be expected to favour Brown-Sequard's theory. Left-handed persons are continually exercising their left or less developed brain in work properly appertaining to the right brain (in this case). Accordingly, with them the two brains are more equally exercised than in the case of right-handed persons. But are the left-handed observed to be ordinarily of better balanced mind than the right-handed? Are they less liable to paralysis of one side of the body, through having each brain readier to discharge the functions of the other? It seems to me that if neither of these relations exists, and I can scarcely suppose that either could exist without having long since been recognised, we may regard Brown-Sequard's theories as interesting perhaps, and even trustworthy, but we can scarcely place much reliance on the hopes which he bases upon those theories.

His next argument seems somewhat more to the purpose. Right-sidedness affects the arms, as we know, much more than the legs. It is presumable, therefore, that there is not so special a relation between the more developed left brain and the action of the right leg, which is only the equal of the left leg, as there is between the left brain and the more skilful of the two arms. In other words, we may assume that both brains control both legs. In fact, if, by equalising the practice of the two arms we are to bring the two brains not only into more equal operation, but into combined action on each arm, it would appear that the equal exercise of the two legs *ought* to have resulted in combining the action of the two brains so far as the control of the lower limbs is concerned. So that we not only may "infer this state of the two brains from the observed powers of the two legs," but unless we do assume this, the hopes entertained by Brown-Sequard must be regarded as to some degree negatived. Now, if the brains do thus act in combination in controlling the lower limbs, it is clear that the complete paralysis of a leg ought not to be so common as the complete paralysis of an arm, for an arm would be paralysed if only one side of the brain were affected, but for a leg to be paralysed both sides of the brain must be affected. Dr. Brown-Sequard states that this is the case at least to this degree, that "it is exceedingly rare that the leg is affected in the same degree by paralysis as the arm."*

The hope entertained by Dr. Brown-Sequard is that by teaching our children to use both sides of the body equally, the two sides of the brain may be brought into more uniform action. "If you have been convinced by the arguments I have given that we have two brains," he says, "it is clear that we ought to develop both of them, and I can say at any rate as much as this, there is a chance—I could not say more, but at least there is a chance—that if we develop the movements of the two sides of the body, the two arms and the two legs, one just as much as the other, the two sides of the brain will then be developed one as much as the other as respects the mental faculties also." There is a connection between the development of the brain as regards the mental faculties and the development as regards leading movements on one side of the body. Therefore, Brown-Sequard considers that, if we train the left side of the body as carefully as we are in the habit of training the right, there is a chance that we should have two brains as respects mental functions instead of one,

* I do not feel quite sure that I have rightly dealt with Dr. Brown-Sequard's argument in this case; because he has presented it very briefly, with the remark that it cannot be understood well except by medical men, and my explanation, not requiring a medical training on the reader's part, is therefore presumably inexact.

XUM

as at present. Since, in cases of disease of the left side of the brain, the right side can be trained to exercise all the functions usually performed by the left side, it seems reasonable to hope that we can do as much for the right side of the brain when the left side is sound. Dr. Brown-Sequard suggests, therefore, that no child shall be allowed to remain either right-sided or left-sided, but be initiated as early as possible into two-sided ways. "One day or one week it would be one arm which would be employed for certain things, such as writing, cutting meat, or putting a spoon or fork in the mouth, and so on. In this way it would be very easy to obtain a great deal, if not all. We know that even adults can come to make use of their left arm. A person who has lost his right arm can learn to write (with difficulty, it is true, because in adult life it is much more difficult to produce these effects than in children), and the left arm can be used in a great variety of ways by persons who wish to make use of it. . . . . There is also another fact as regards the power of training. Even in adults, who have lost the power of speech from disease of the left side of the brain it is possible to train the patient to speak, and most likely then by the use of the right side of the brain, the left side of those patients, with great difficulty, will come to learn. The same teaching we employ with a child learning to speak should be employed to teach an adult who has lost the power of speech. So also as regards gesture, and other ways of expressing ideas. I have trained some patients to make gestures with the left arm who had lost the power of gesture with the right, and who were quite uncomfortable because their left arm, when they tried to move it, at times moved in quite an irregular way, and by no means in harmony with their intention. There is a power of training, therefore, for adults; and therefore that power no doubt exists to a still greater degree in the case of children; and as we know that we can make a child, who is naturally left-handed, come to be right-handed, so we can make a child, who is naturally right-handed, come to be left-handed as well. The great point should be to develop equally the two sides of the body, in the hope that by so doing the two sides of the brain, or the two brains, may be brought into harmonious action, not only as respects bodily, but also as respects mental functions."

I have thus brought before the reader the hopes, as well as the theoretical views, of Dr. Brown-Sequard. I must say in conclusion that, although for my own part I do not regard his hopes as altogether well based, believing, in fact, that many familiar experiences are against them, I attach great importance to the theoretical considerations to which he directs attention. We may not be able to increase general mental power, and still less to double mental power by calling the two sides of the brain into combined activity (as respects intellectual processes), yet if we recognise the duality of the brain in this respect we may find it possible to assist the reasoning side of the brain in other ways. For instance, it may be found that by considering the facts to which Brown-Sequard has called attention we can more clearly understand the advantage which the student has long been known to derive from special forms of relaxation It may, for instance, be a specially desirable change for the student to have his emotions called into play, because the overworked reasoning part of the brain obtains in that way a more complete rest. When either side of the head is suffering from temporary ailments, as in migraine (hemikranion), special forms of mental* or bodily exercise may be found useful to remove or alleviate the suffering. And it cannot be but that, in studying the effects of such experiments as Brown-Sequard suggests, light would be thrown on the interesting and perplexing subject of the brain's action in relation to consciousness and volition. If in addition to such useful results as these it should be found that by careful training on Brown-Sequard's plan the duality of the brain can be made a source of increased mental power, or of better mental balance, or of readier decision, so much the better. The progress of science calls for increased mental activity. We want more powerful brains than served our forefathers, for we try to grapple with more difficult questions. The idea is at least pleasing to contemplate, though I fear it is based as yet on no very firm foundation, that as binocular vision gives a power of determining the true position of objects which the single eye does not possess, so bi-cerebral thought may supply a mental parallax enabling men to obtain juster views of the various subjects of their thoughts than they can obtain at present by mental processes which are known to be one-sided.

* An experience of my own seems to suggest this as possible. On one occasion, when I was about to deliver a lecture to a large audience (the largest I had ever addressed, in fact, and computed at nearly 3,000), I was suffering from a headache affecting the right side of the head so severely that the slightest movement caused intense pain, and every breathing was responded to by a dismal throbbing of the brain. The headache was not occasioned by excitement, but was connected with a general disturbance of the system from a severe cold, and was intensified by a journey from Chicago to New York (where the lecture was delivered), completed only two or three hours before the lecture began. During the first ten minutes of the address the pain was very great indeed, and was rendered more severe by the effort required in addressing so large a meeting with a voice affected by catarrh. But from that time the pain grew less, and at the end of the lecture no trace of it remained. The headache did not return after the lecture was over; in fact, the rest of the evening was passed in such manifest enjoyment of pleasant converse at the Century Club, that several "Centurions" who had heard the lecture must in all probability have found it difficult to reconcile the circumstance with the lecturer's statement about his illness. [Ah! goodly fellowship of "Centurions"! where else in the world are so many genial souls gathered together? and where else in the world does the stranger receive so warm a greeting?]

THE YOUNG ELECTRICIAN.

By W. Slingo.

(*Continued from p.* 193.)

HINTS ON DRILLING.

Although we have already spent what might appear to be an inordinately long time in discussing the subject of drilling, there yet remains something to be said in order to render our remarks sufficiently complete to enable the young electrician to perform his work efficiently, and to avoid the necessity for again referring to the subject.

Ex. XXXVI.—A few hints may here be given, a due regard for which will help considerably in the effort to perform drilling successfully.

(*a*) The point of the drill should be in the middle of the blade.

(*b*) The blade should have sufficient thickness to impart the strength necessary to minimise the risk of breaking, while, at the same time, it must not be so thick as to prevent the fine metal cuttings produced by the drill escaping from the hole as the drill makes its way inwards.

(*c*) Only the best steel should be employed in making drills, and they should be carefully hardened, over-heating being most cautiously guarded against. Failure in drill-making results more frequently from "burning" the steel than from imperfect hardening and tempering.

(*d*) The drill in rotating must run truly throughout its

whole length, in order that it may be able to sustain the end pressure exerted upon it to cause it to bite the metal being drilled, and at the same time to prevent its bending.

(*e*) The young worker is apt, if he thinks his drill has softened, to immediately proceed to re-harden and temper it, but this should not be done unless it is really soft, for a too frequent application of the process impoverishes the quality of the steel. Drills so treated are rarely of any real use. It may be mentioned that the prime cause of softening is working the drill too rapidly—at a greater speed, in fact, than the apparatus employed will permit.

(*f*) When drilling steel, wrought-iron, or other hard metal, the work must be done slowly, with more pressure than is necessary for the softer metals, and with a good supply of oil. Should this fail, alter the cutting edges of the drills, making their inclination somewhat less acute—approaching, that is, a little nearer to a flat edge. When drilling brass or other soft metal, oil is not necessary.

(*g*) The drill should be kept sharp. This may be done by occasionally rubbing the cutting edges upon an oil-stone.

Ex. XXXVII.—In the event of the young electrician not caring to make his own drills, he may buy them at a very low figure. Messrs. Melhuish & Son, of Fetter-lane, E.C., supply them at 1s. 6d. per dozen, assorted. I may mention that I have received from this firm a box containing forty-eight drills of sixteen assorted sizes with a drill-stock. They are of first-class workmanship and in every way commendable.

Ex. XXXVIII.—It not unfrequently happens that when a hole has been drilled it proves a little smaller than is required, in which case a handy little tool known as a broach may be employed to enlarge the hole to the required size. Fig. 16 illustrates this piece of apparatus

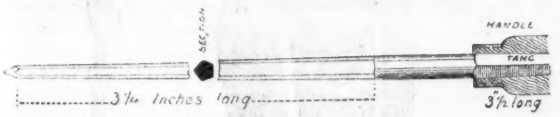


Fig. 16.

very clearly. It may be procured at any tool shop. It consists of a steel wire cut to a pentagonal section and slightly tapering from the tang or thereabouts to the point. The shape of the point is clearly shown on the diagram. The tang is cut square so that it can be held in a hand vice or fixed into a wooden handle as shown. The broach illustrated is 3½ in. long, but the length varies with the size, the stronger ones being longer than the finer. To use the tool, place the point in the drilled hole and rotate it gently, using oil when working the harder metals (see Ex. xxxvi. *f*.).

FILES AND FILING.

This is a most important branch of the young worker's labours, and requires some little attention.

The majority of aspirants to mechanical skill seem to agree in the difficulty they experience in their endeavours to file flat; but, if our young electrician will only set himself steadily to work to accomplish this much-to-be-desired feat, he will speedily find himself master of the task. It is simply a question of practice and attention.

Ex. XXXIX.—Let us suppose that it is desired to file, or produce by filing, a flat surface. To do this, procure a file longer than the material to be worked. Then take hold of the handle by the right hand, placing the left on the point of the file. Then proceed to work the tool backwards and forwards, letting it pass over the full width or length of the surface being filed at each stroke. It is with this view that a file longer than the material is recommended. Every effort must be made to keep an equilibrium or balance between the action of the two hands, as the file is moved forwards and backwards, more especially in the forward stroke. Pressure should only be exerted in this forward stroke, that is to say, the file should only be permitted to cut one way. As a matter of fact, the teeth of the file are so shaped as to render it impossible to produce a cut during the backward stroke, which, at most, can only produce a scratch. When the metal being filed happens to be hard, there is a liability of spoiling the file, if any attempt is made to cut during the backward stroke. No pressure should therefore be applied during this movement. By filing steadily and attentively, the hands will speedily acquire the necessary degree of sensitiveness to enable each to adjust its pressure in proportion to the other, as well as the knack of maintaining a flat surface. The file should always be moved in a straight line, more particularly when administering the finishing touches. Curved file-cuts are an abomination. Care should also be taken to avoid short and jerky movements. But let each motion be bold and resolute, as though it were intended that something must go.

The student will do well to practise the art of filing on odd pieces of metal, placed in a vice or other convenient means for keeping them steady.

New files should first be used on brass. A little use in this way will bring them into good condition for iron and other harder metals, but, when once so used, they are spoiled so far as softer work is concerned. A file, that is, which has been used for cutting iron, will not work satisfactorily on brass or copper.

It is often necessary, or rather one is often compelled, to file with one hand. In such cases, there is an increased tendency to produce anything but a horizontal surface. Here, again, practice must be resorted to to obtain the proper or requisite degree of efficiency. The material to be filed may be laid on a piece of cork or wood, placed in a vice, and worked with a small-size file held in the right hand. Every effort must be made to place the file in a horizontal position at each forward stroke, the pressure applied being light. A sort of instinctive feeling will, after a little practice, indicate when the file is not working right, and so enable the worker to adjust the pressure and force needed to maintain horizontal working. It frequently happens that small articles may be held against the fore-finger of the left hand while the filing is performed with the right. Success in this method of filing is not difficult to attain—less so, in fact, than when the material is laid on the piece of cork or wood.

Ex. XL.—Files are divisible into three classes, according to the relative fineness of the teeth or cutting edges. They are

(*a*) Smooth, in which case the teeth are very fine indeed.
(*b*) Second-cut, a little coarser.
(*c*) Bastard, or coarse-cut.

Ex. XLI.—Files are made in six shapes, each of which is obviously adapted to a particular species of work. These shapes are

(*a*) Flat, in which there are two more or less wide cutting faces parallel one to the other. One of the narrow faces or edges is also provided with teeth.

(*b*) Three-square (shown in section in Fig. 5, page 103), in which there are three flat cutting faces, each making an angle of 60° with the others.

(*c*) Square, in which there are four flat cutting faces at angles of 90°.

(*d*) Half-round (shown in Fig. 4, page 103), in which

there are two cutting surfaces, one flat, and the other more or less rounded.

(*e*) Round, in which if a cross section be taken at any part of its length we shall get a circle. Round files, when small, are called rat-tail.

(*f*) Crossing (shown in section in Fig. 6, page 103), in which there are two rounded cutting surfaces, struck from different radii.

The young electrician can purchase his files, as he may require them, at any tool-shop. They are inexpensive tools.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

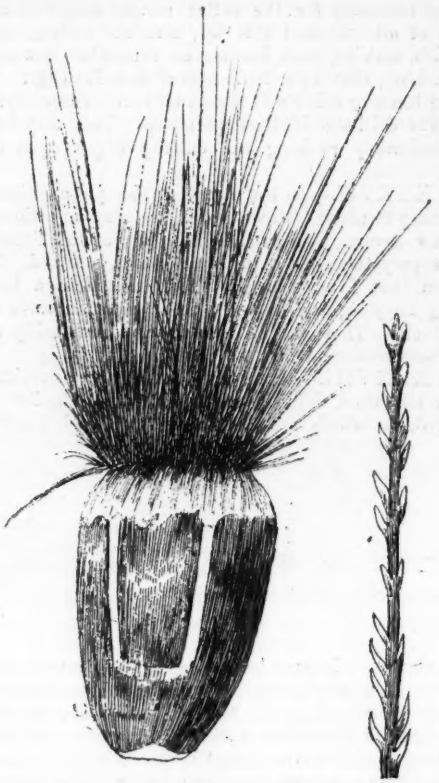
MESSRS. CARTER & CO., the well-known gardeners and florists, have issued boxes of seeds interesting to microscopists. The largest of the three collections contains 100 specimens, some very curious, and many of considerable beauty as low-power objects. A few seeds are pretty generally known to possessors of microscopes, but this is, I believe, the first time an opportunity has been offered of making a comprehensive study of many genera and species. The seeds are sent out in little wooden boxes, each having a number on its lid by which reference can be made to a list of names on the inside of the cover of the square box that holds the lot. There is no method in the arrangement, and the first thing the buyer had better do is to pencil the bottom of each box with the number found on the lid. This enables the covers of several to be taken off at one time without risk of their being subsequently misplaced. After this, those who are not well up in botanical names and classification should refer to such a book as "The Treasury of Botany," and mark the list with a few letters intimating the family each seed belongs to. Abbreviations are handy, such as *comp.* for composite; *ranun.* for ranunculus or daisy family, and so forth.

Amongst the Composites will be found many of the prettiest and most curious objects to be viewed as wholes with powers, according to their size, from four inches up to one inch, or two-thirds. When, as is often the case, the pappus hairs are elegantly branched, or adorned with little imbricated and pointed scales, they are worth viewing with higher objectives, and may be mounted in Canada balsam.

There is a great deal of character in the downy sails which enable the winds to carry off the seeds of the thistles and similarly-provided Composites; and botanists refer to them as offering specific distinctions. Some seeds of Composites, however, are destitute of these appendages, and we find in Carter's collection a very pretty one—that of the handsome garden flower, *Calliopsis tinctoria*. The seeds of this plant are flattish, boat-shaped, in-curved objects, about $\frac{1}{12}$th of an inch long, beautifully marked with minute pits, and sprinkled over with whitish dots like little bits of sugar. This is a fine object with a magnification of about fifty linear, and a strong light to show up its bright brown and blackish hue.

One of the finest of the Composite seeds is that of *Cyanus major*, the Cornflower. This requires very little magnification, but a bright light. It is like a beautifully-made shuttlecock, the solid conical part about a quarter of an inch long, surmounted with a fine group of hairs. The colours are rich brown. The figure herewith shows its appearance as a whole, slightly magnified, and also that of a portion of one of the hairs magnified fifty times linear. When mounted in balsam, these hairs are richly-coloured polariscope objects.

The seeds of *Cyanus minor*, also in the collection, are extremely pretty, but smaller, and of light hue. Another Composite seed, which is a favourite with microscopists who know, is that of *Sphenogyne speciosa*. It is a Cape plant, said to be handsome in gardens, and some reader may know it. I do not, and therefore quote "The Treasury of Botany," which says of the members of this genus:—"They have an imbricated involucre, the inner scales of which, or all, have a dilated scarious termination; the receptacle is paleaceous (scaly), and the pappus simple in a single row of obovate, or wedge-shaped, blunt scales, which become opaque white when mature. They have large, spreading flower-heads of an orange colour, barred with black."



Cyanus major seed. × 50.

The seed, arranged for the microscope, looks like a complete plant. The scales at the top should be neatly spread out, and thus form a cabbage-shaped flower; the solid part looks like a stem, and a tuft of hairs at the bottom has the aspect of fibrous roots.

A great many of the hairy appendages of Composite seeds reflect light very strongly, and some of the thistles fight their battle of life so vigorously as to take possession of considerable spaces to form large colonies. The winds often carry off swarms of the downy objects, and an incident of this kind was the probable cause of a curious telescopic observation accidentally made by the writer some years ago. The telescope was pointed to look at one of the planets in the daytime, when the sky was clear and the sun brilliant, and for several hours appearances like showers of falling stars were visible. They were momentary flashes of white light, most sharply seen when the instrument was focussed to show the planet, thus indicating that they were sufficiently far off to be seen with horizontal rays only. After

Night Sign for March.

watching their appearance for some time, I drove over to Captain Noble's observatory, about five miles off, and found that his telescope did not exhibit anything of the kind. The road being very hilly, and some time being spent with him, I did not get home till some two hours after starting, and still the light showers were visible. The total quantity must have been very large, and nothing could be thought of so likely as thistle-down to have produced the pretty effects.

The pappus hairs of the Composites are usually the most interesting parts for microscopic observation, though the seed itself—as in the Cornflower—is often beautiful. In many other families the *testa*, or external membrane, is decorated with fine markings, and the seed may be of curious shape. Hairs, scales, pits, ribs, &c., vary the aspects of those represented in Carter's collection, to which it is proposed to return on other occasions; but as variety is desirable to suit various tastes, the next paper will be on quite another subject—the so-called molecular, or Brownian, movements of small particles suspended in fluids. In this matter there is still room for fresh investigation.

THE ELECTRIC LIGHTING ACT.—At a meeting of the General Committee formed to frame amendments of the Electric Lighting Act, 1882, for the consideration of the Board of Trade, held at the Offices of the Anglo-American Brush Electric Light Corporation, on March 11, Lord Thurlow presiding, the report of the Executive Committee and a Draft Bill amending the Electric Lighting Act, 1882, on the basis of the Gas Acts, were submitted. The details having been explained, it was resolved unanimously, on the motion of Viscount Anson, that the report of the Executive and the Draft Bill be approved. The Chairman was asked to communicate with the President of the Board of Trade with a view to a deputation attending to learn his views on the proposals of the Committee.

ZODIACAL MAPS.

IN fulfilment of the promise given on p. 189, we repeat here the Night Sign for March, thus completing the series of twenty-four Zodiacal Maps.

THE PHILOSOPHY OF CLOTHING.

BY W. MATTIEU WILLIAMS.

IV.—THE COOLING ACTION OF THE SKIN.

THE question suggested by some of the facts stated in my last is, How is the temperature of the body kept down when it is surrounded with an atmosphere saturated with vapour, and considerably above blood heat? We must always remember that superficial evaporation only takes place when the surrounding air is not already supplied with its full quantity of the vapour in question. In this case it is the vapour of water to the formation of which the whole work of cooling the body is usually attributed.

If no other gaseous matter than aqueous vapour—*i.e.*, water in the gaseous form—were given off from the skin, I should say "give it up" to this physiological riddle; but such is not the case. Other gases accompany the gaseous water, and, if those gases are evolved by the expansion of bodies that were previously in a solid or liquid condition, this evolution can only be effected at the expense of much sensible heat by a lowering of temperature proportionate to the amount of the expansive work performed.

Spallanzani, Abernethy, Milly, Jurine, Ingenhous

Barruel, Collard di Martigny, Brunner, Regnault, Reiset, Valentin, and others, have made experiments proving the evolution of carbonic acid and nitrogen gases from the skin. They collected these gases and analysed them.

I find that, whenever I take a warm bath, and remain for a short time reclining in the water, bubbles of gas run up my back and come to the surface of the water. If I then rub my hands along the surface of my body, especially the sides or the back, a multitude of minute bubbles are poured upwards, producing quite an effervescence. I suppose that such is the case with other people, and therefore suggest a repetition of this simple experiment to my readers. They should remain quite still for about five minutes, and then make the observation and experiment above described. I find that the hotter the water the more striking is the result, as though the heating of the body promotes the formation of the gas. I have tried it with water painfully hot.

The crucial question in reference to this problem is whether this expiration of gases by the skin is performed merely in exchange for gases previously inspired, as in the lungs, where we inspire a given bulk of air (oxygen and nitrogen) and expire the nitrogen unchanged, and some carbonic acid in exchange for some of the oxygen, the expired carbonic acid having the same bulk (allowing for differences of temperature) as the inspired oxygen which it replaces. Such being the case, no heat is rendered latent by this part of the transaction.

My experiment in the bath, so far as it goes, indicates an expiration under circumstances excluding the possibility of corresponding inspiration by the skin. I say "so far as it goes," being fully aware that to prove or disprove this generally demands an amount of delicate and careful research which I cannot afford to undertake. The experimental investigations that have been made are extremely interesting; but I am not able to find a record of any directly devoted to the elucidation of this question. Regnault and Reiset, by means of a very elaborate apparatus, figured in Valentin's "Physiology," collected all the products of respiration and transpiration from a dog confined in a receiver and supplied with measured quantities of air. But these and other similar researches leave open the question of whether the blood, in passing through the hundreds of miles of capillary vessels of the cutis, may, or may not, when raised a little above its normal temperature, give out carbonic acid and nitrogen, which has been produced by reactions among some of its liquid or solid constituents.

I think that it does; but this is merely an opinion based on presumptive evidence, and such opinion is not science, it is merely suggestion that may lead to science.

I may describe one observation made on myself which is curious and particularly suggestive. I have on my left hand, arm, and breast an abnormal development of superficial blood-vessels, a "wish mark," as it is called, of extraordinary area. It covers the thumb and fore-finger, half the palm, and about one-third of the back of my left hand, continues as a broad band—from two to three inches wide—up the whole length of my arm, and then spreads out on breast, neck, and part of shoulder. I have seen a large number of such "marks," but no other so large. There is no swelling of the skin, no abnormal sensitiveness, but simply an exaggerated vascular development of the cutis.

That such is the structure is proved by the red colour, although the cuticle is colourless, like that of the lips; by the experiment of pressing any part so as to squeeze away the blood, when it becomes of normal skin colour by this retreat of blood, and immediately regains its deep red colour as the blood returns; also by the fact that a slight wound bleeds profusely, far more so than a corresponding wound on other parts of the skin.

The blood diffused over this large surface is subject to remarkable changes. Sometimes it is dark purple venous blood, approaching to blackness, the livid hue of a cholera victim in the last stage of collapse. At other times, it has the brilliant colour of purely arterial blood. Between these it assumes various tints of crimson. The changes are unaccompanied with any personal inconvenience beyond a slight sensation of numbness when the purple condition is fully displayed.

These variations correspond to variations of temperature. In cold air or cold water it is purple; in hot air or hot bath, scarlet, with intermediate gradations according to temperature.

But this is not all. I can localise the colour at will. When my hand and arm have become purple by exposure to cold, I can redden the thumb or the finger *only*, by dipping it in hot water or otherwise subjecting it to a temperature a little above normal blood heat.

I find that if I expose myself to a degree of cold sufficient to fill these superficial vessels with venous blood of dark purple colour, and then take a warm bath with this purple surface completely immersed, the blood becomes arterialised and bright red, this change being accompanied with the evolution of the gas-bubbles above described.

In this case there can be no cutaneous inspiration, but there does appear to be an expiration of gas, and there certainly is removal of carbon, either by oxidation, mechanical exchange, or dissociation. The change may be simply mechanical; it may be that, when cooled, the capillary vessels are congested, and the flow of arterial blood retarded, while, on the other hand, the warmth may relax these vessels, and enable the circulation to proceed more rapidly. This is the most direct and plausible explanation, but it does not improve when more searchingly examined.

Whether this superficial circulation be slow or rapid, the blood in the capillaries comes from the arteries. It was red arterial blood immediately before entering them. What occurs upon the surface to convert it into venous blood when exposed to low temperatures? If the skin acts like the lungs, if the carbonic acid proved to be expired from the skin is simply the original oxygen previously inspired, and thereby combined with carbon, this action should occur most vigorously when the skin is doing its warming work, as such oxidation is a heat-evolving process, and it should be more effective when the blood remains exposed for the longest period—*i.e.*, when the congestive action is the most effective; but exactly contrary is the case. It is just when the skin is doing the work of cooling the body that the blood is brightest on the surface.

It must be noted that what I described as occurring so strikingly on this tissue of exaggerated vascularity also occurs, but less visibly, on the normal skin. The lips, the nose, the cheeks, the finger-ends turn blue when exposed to extreme cold, and become florid when excessively heated.

My question now reduces itself to this definite form: Is the carbonic acid evolved from the skin a product of internal combination of *solid* or *liquid* oxygen with *solid* or *liquid* carbon? If so, the expansion from the solid or liquid to the gaseous form accounts for the cooling action of the skin, under conditions where the mere superficial evaporation of water is insufficient.

But some of my readers may say that oxygen is only a gas, having seen it in this form on lecture tables, and read of it as "oxygen gas." This is a popular error. Oxygen, like every other known element, may exist in all the three states of solid, liquid, and gas—does thus exist. The simple facts that eight-ninths, or above 88 per cent., of the water of

the ocean is oxygen, nearly half of the solid crust of the earth is oxygen, while in the air there is but one-fifth, show that solid and liquid oxygen are important factors that must not be overlooked.

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By MONS. DE FONTENELLE.

WITH NOTES BY RICHARD A. PROCTOR.

(*Continued from p.* 200.)

THE FIFTH EVENING.

"BUT," says the Marchioness, "if you build upon this resemblance or likeness which is between our sun and the fixed stars, then, to the people of another great vortex, our sun must appear no bigger than a small fix'd star, and can be seen only when 'tis night with them."

"Without doubt, madam," said I, "it must be so. Our sun is much nearer to us than the suns of other vortexes, and therefore its light makes a much greater impression on our eyes than theirs do. We see nothing but the light of our own sun, and when we see that it darkens and hinders us from seeing any other light; but in another great vortex there is another sun, which rules and governs, and in its turn extinguishes the light of our sun, which is never seen there but in the night, with the rest of the other suns—that is, the fix'd stars. With them, our sun is fast'ned to the great arched roof of heaven, where it makes a part of some Bear or Bull; for the planets which turn round about it (our earth, for example), as they are not seen at so vast a distance, so nobody does so much as dream of 'em. All the suns then are day-suns in their own vortexes, but night-suns in other vortexes. In his own world or sphere every sun is single, and there is but one to be seen; but everywhere else they serve only to make a number."

"May not the worlds," reply'd the Marchioness, "notwithstanding this great resemblance between 'em, differ in a thousand other things? For tho' they may be alike in one particular they may differ infinitely in others."

"It is certainly true," said I; "but the difficulty is to know wherein they differ. One vortex hath many planets, that turn round about its sun; another vortex has but a few. In one vortex there are inferior or less planets, which turn about those that are greater; in another, perhaps, there are no inferior planets. Here all the planets are got round about their sun, in form of a little squadron, beyond which is a great void space, which reacheth to the neighbouring vortexes; in another place the planets take their course towards the outside of their vortex, and leave the middle void. There may be vortexes also quite void, without any planets at all; others may have their sun not exactly in their center, and that sun may so move as to carry its planets along with it; others may have planets which in regard of their sun ascend and descend, according to the change of their equilibration, which keeps them suspended. In short, what variety can you wish for? But I think I have said enough for a man that was never out of his own vortex."

"It is not so much," reply'd the Marchioness, "considering what a multitude of worlds there are: what you have said is sufficient but for five or six, and from hence I see thousands."

"What would you say, madam, if I should tell you, there are many more fix'd stars than those you see? And that an infinite number are discovered with glasses, which cannot be seen by the naked eye? One single constellation, where perhaps we count only twelve or fifteen, there are as many more to be found as usually appear in the whole hemisphere."

"I submit," says she, "and beg your pardon; you quite confound me with worlds and vortexes."

"I have more to tell you, madam," said I: "You see that whiteness in the sky, which some call the Milky-way; can you imagine what that is? 'Tis nothing but an infinity of small stars, not to be seen by our eyes, because they are so very little; and they are sown so thick one by another, that they seem to be one continued whiteness. I wish you had a glass to see this ant-hill of stars, and this cluster of worlds, if I may so call 'em: they are in some sort, like the Maldivian Islands. Those twelve thousand banks of sand, separated by narrow channels of the sea, which a man may leap as easily as over a ditch; so near together are the vortexes of the Milky-way, that the people in one world may talk and shake hands with those of another; at least, I believe the birds of one world may easily fly into another; and that pigeons may be train'd up to carry letters, as they do in the Levant. These little worlds are excepted out of that general rule, by which one sun in his own vortex, as soon as he appears, effaces the light of all other foreign suns*. If you were in one of these little vortexes of the Milky-way, your sun would not be much nearer to you, and consequently would not make any much greater sensible impression on your eyes, than 100,000 other suns of the neighbouring vortexes. You would then see your heaven shine bright with an infinite number of fires close to one another, and but a little distant from you; so that tho' you should lose the light of your own particular sun, yet there would still remain visible suns enough, beside your own, to make your night as light as day; at least, the difference would hardly be perceiv'd; for the truth is, you would never have any night at all. The inhabitants of these worlds, accustomed to perpetual brightness, would be strangely astonish'd if they should be told that there are a miserable sort of people, who, where they live, have very dark nights, and when 'tis day with them, they never see more than one sun; certainly they would think nature had very little kindness for us, and would tremble with horror, to think what a sad condition we are in.

(*To be continued.*)

TRICYCLES IN 1885.

By JOHN BROWNING.

(*Chairman of the London Tricycle Club.*)

THE NEW TYPE OF TRICYCLE.

IN my previous article I said that I considered the Cunard front-steerer as a typical specimen of the newest and most improved form of tricycle. Until this type of machine was produced, I confess that I thought it possible that rear-steerers might be improved so much that they would hold their own with front-steerers. Now I no longer think so.

All rear-steering machines have one disadvantage which is an undoubted and serious drawback to their many good qualities—they are, under some conditions, uncertain in their steering down-hill; not but what they may be ridden

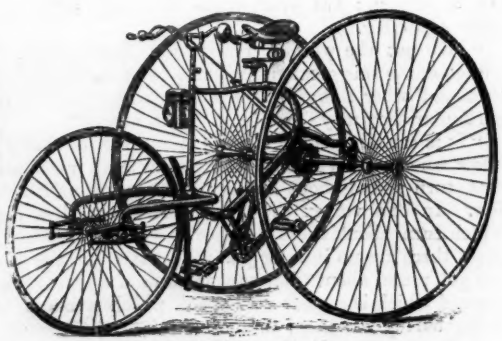
* Fontenelle here adopts a sounder view of the Milky Way than that which attributes its light to long ranges of stars distributed as to the distances between them like the stars in our sun's neighbourhood.—R. P.

at a great pace down hill with practice when the road is fairly straight and the way is clear; but if it is necessary to check their speed, either by applying the break or by back-pedalling, then the steering becomes uncertain. From their possessing this fault, front-steerers, which are now quite as

The Cunard.

The Central-Geared Rucker.

The Pioneer.



The Quadrant, No. 8.

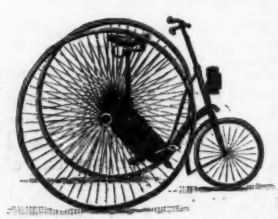
fast on the level, and almost as fast up-hill as rear-steerers, will eventually completely eclipse them.

It will be seen by the engraving, that the Cunard front-steerer has a T-shaped frame and is central-geared—that is, that the chain is in the centre, between the legs of the rider. This form of frame is the lightest that can be made.

The driving-wheels are small, not exceeding 42 in. in diameter. The front wheel is large, not less than 20 in. in diameter. The steering-wheel is thrown from 4 in. to 6 in. further forward than usual. The rider sits from 4 in. to 6 in. in front of his axle. The steering is effected by a pair of bicycle handles at opposite ends of a lever in front of the rider. There are no stay-rods or safety-rods behind the machine, because they are not required, as it is impossible either by pedalling or even by pulling at the handles to capsize it backwards; stay-rods would therefore be superfluous. This machine only requires a good brake to make it the lightest roadster yet introduced.

I propose giving engravings of three other front-steerers, made on the same lines and varying only in details of construction.

The machine made by Messrs. Humber, Marriott, &



The Humber Automatic Steerer.

Cooper, known for some time as the Cripper, but now advertised by the name of the Humber Automatic Steerer, was brought out at least a year before the Cunard, and it possesses the great advantage of having an efficient break, and is therefore a first-class roadster, but on two points I think it would be possible to improve it. First, and most important, it might have a larger front steering-wheel to reduce the vibration, and, secondly, it might have more

than two ball-bearings to the axle to reduce the friction by preventing it from bending. Yet both these suggestions I make with hesitation, as they may not be of much consequence, for the ingenious makers have arranged a spiral spring on the front fork, which absorbs some of the vibration of the small steering-wheel, and they have brought the two ball-bearings so close together that the strain on the axle can cause but little flexure of the short portion of the axle between them. All the riders of this machine with whom I have spoken have praised its performance highly, and of course the workmanship, style, and finish are superb.

The Quadrant, No. 8, with bicycle-steering, differs principally from the machine I have just described in having a front steering-wheel, 26 in. in diameter. The driving-wheels are made from 40 in. to 44 in. diameter to order. The machine has a strong band-break on the bicycle steering-handle, and a reserve or safety-break which can be applied by the foot to the front wheel. This machine should be freer from vibration than any other tricycle. The weight of either of the three machines I have named made as a special light roadster with break would be under 60 lb.

The well-named Pioneer made by Pausey is constructed on the same general plan as the machines I have just described, but the driving-wheels are only 36 in. diameter, geared up to drive as 60. Owing to the small size of the wheels, the weight of the machine is reduced to less than 50 lb. This is the first attempt known to me to introduce a small geared-up tricycle, and I shall be greatly obliged if any one who has ridden one of these machines will inform me whether his experience of it is favourable, as I should expect it to be.

The Central-Geared Rucker, with direct steering, is very similar to the four machines I have described. The great peculiarity is that the rod turned by the steering-handles is attached directly to the centre of the front steering-wheel, by a double joint known to mechanics as Hook's joint.

This steering arrangement I have just had applied to my own small central-geared Rucker, and very shortly I will report on its performance.

Once the best form for the tricycle has been found—and I doubt if the tricycle of the future will vary much from the lines of those I have described—we shall get the machine improved in details. Only when this has been carefully done can we hope to have machines which will compare favourably with bicycles, the details of which have been elaborated until there scarcely seems room left for their further improvement.

CHATS ON GEOMETRICAL MEASUREMENT.

By RICHARD A. PROCTOR.

(*Continued from p.* 126.)

VOLUMES AND SURFACES OF SOLIDS.

A. We have now done a good deal in the way of determining the areas of various conic and cycloidal areas, and I think we have sufficiently tested the method of dividing them up into numerous (I may say numberless) indefinitely small portions. I would submit that it would now be well to consider those surfaces, volumes, and so forth, which we are more apt to meet with in ordinary life. I cannot say that I ever had occasion for precise information about the area of a parabola or hyperbola, neither do the cycloidal curves come many times a day under my notice. But I often want to know the approximate volume of globes, cylinders, cones, and so forth, because questions of interest (to me, at any rate) often depend on such knowledge. Only the other day, for example, my friend Stout was speaking of a cylindrical vat so many feet deep and so many broad, and the question arose how much the contents of that vat, in beer (of known specific gravity) would weigh; but I did not remember the formula for the volume, and did not at the moment see my way to determining it independently.

M. There ought to have been no difficulty on that point; when you are dealing with spherical volumes and surfaces, or with the volumes and surfaces of cones, spindles, and so forth, you might not see your way to determine the correct value, but the volume of a solid like a cylinder, which has the same cross section all the way up (supposing it to stand on a circular base) is obviously given by multiplying together the numbers representing the height and the area of the base.

A. Let us, however, consider these more familiar and useful matters, at length.

M. Willingly. As regards curved surfaces we shall not have occasion for any knowledge beyond that which you already have. But as regards solids it is necessary that you should know what is not given in the parts of Euclid usually read,—the relations between the volumes of pyramids, prisms, and parallelopipeds.

A. Why?

M. Because we cannot deal generally with solids without dividing them into their simplest elements, and as the triangle with its three sides is a simpler element of an area than the parallelogram with four, so the triangular prism with nine edges and five faces is a simpler element of a volume than the parallelopiped with twelve edges and six faces, while the triangular pyramid with six edges and four faces is a simpler element of volume even than the prism.

A. Tell me, then, what are the relations necessary to be known and understood?

M. Note, first, then, that the volumes of parallelopipeds and prisms of all kinds are very simply dealt with. Parallelopipeds are indeed prisms, and need not be separately considered, were it not that the rectangular parallelopiped is the form to which all volumes are most conveniently reduced, just as rectilinear areas are best represented by rectangles.

A. Shall we then first take the triangular prism?

M. We may treat this solid as triangles are dealt with in the first book of Euclid, only we need not enter quite so carefully into details as Euclid deemed it his duty to do. Let A E C, *a e c*, be prisms on equal triangular bases A B C, *a b c* (B and C are supposed to be farther from the eye than A C and *b c*), and between the same parallel planes, A B C, *a b c*, and D E F, *d e f*. To compare their volumes, take two planes close together and parallel to the parallel planes between which the prisms stand. Let these two close planes cut from the prisms the thin triangular slices P Q R and *p q r*. Then these triangular slices are manifestly equal in volume.

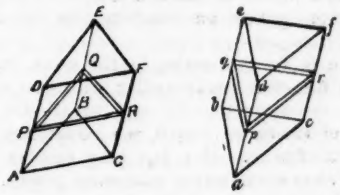


Fig. 1.

A. I do not see that they are more obviously equal than the prisms A E C and *a e c*. They are both prisms, and

they stand on equal bases, and lie between the same parallels.

M. True. But observe that owing to their being very thin,—in fact, of indefinite thinness,—each may be regarded as a rectangular or upright prism. The volume lying between the enclosing planes of P Q R, differs from the volume of a rectangular prism on the lower triangle P Q R and between the same planes, only by three exceedingly thin triangular prisms, which become indefinitely small ultimately compared with either. About the equality of two rectangular prisms on equal bases and of the same height there can, of course, be no doubt, since each can be divided into the same (indefinitely large) number of indefinitely small parallelopipeds, of the same height as the prisms, but of exceedingly small cross section, and all of nearly the same volume.

A. The slices P Q R, *p q r* are then equal.

M. Yes; and as the two prisms may be divided thus into an indefinite number of slices, each slice of one being equal to the corresponding slice of the other, it follows that the prism A E C is equal to the prism *a e c*.

A. Of course it follows from this demonstration that *Triangular prisms on the same base and between the same parallels are equal.*

M. Yes; and also it is obvious that *Triangular prisms on equal (triangular) bases and of the same altitude, or between equidistant parallels, are equal.*

A. Do we next pass to parallelopipeds?

M. We might prove, in just the same way, that *Parallelopipeds on equal bases and between the same or equidistant parallels or of the same altitude, are equal;* but we may conveniently make this a corollary from what has just been shown about prisms.

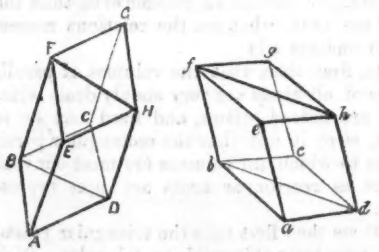


Fig. 2.

A. How so?

M. Let A C F D *a c f d* (Fig. 2), be parallelopipeds on equal bases A B C D, *a b c d* (B C, *b c*, remote from the eye), and between the same parallel planes E *g*, A *c*. Then if we draw B D, F H, *b d*, *f h*, we manifestly divide each rectangle into two prisms on triangular bases; and since A B D = B C D = *a b d* = *b d c*, and the prisms on these equal bases are between the same parallels, they are all four equal. Thus the parallelopiped A G is equal to the parallelopiped *a g*, these parallelopipeds being double the equal triangular prisms on bases B A D, *b a d* respectively.

A. How about prisms on quadrangular but not rectangular bases?

M. You can show directly, in the same way as with triangular prisms, that quadrangular prisms on equal bases and between the same parallels are equal—for, in Fig. 1, the equality of the strips P Q R, *p q r* does not depend on their being triangular. But you may employ what has been already shown respecting triangular prisms.

Thus let A B C D, *a b c d* (Fig. 3) be the equal quadrangular bases of the prisms A G, *a g*. Then drawing C K, parallel to B D, to meet A D, produced, in K, we have th triangle B K D equal to the triangle C B D, and therefor the prism on base B D K equal to the prism of same altitude on base B C D, or—adding the prism on base A B D to both—the prism on base A B K is equal to prism of same altitude on base A B C D. So making triangle F L E

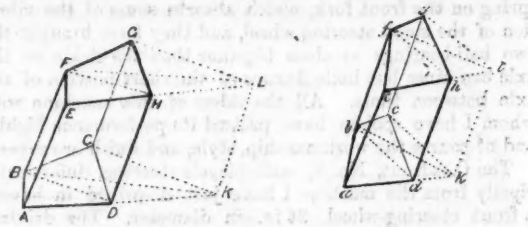


Fig. 3.

equal in all respects to triangle B K A, we have the triangular prism A F K equal to the quadrangular prism A G. Make in like manner the triangles *a b k*, *e f l* equal to the quadrangle *a b c d*, and we get the prism *a f k* equal to the quadrangular prism *a g*. But the triangles A B K, *a b k* are equal, being severally equal to the equal quadrangles A B C D, *a b c d*; hence prism A F K = prism *a f k*; wherefore prism A G = prism *a g*.

A. Clearly this method can be extended to prisms having any number of angles.

M. Yes; we obviously obtain this general result. *Prisms of equal altitude and on equal bases, triangular, quadrangular, or polygonal, are equal.* And obviously it matters not whether the prisms have the same or a different number of angles. If their bases are equal and their altitudes equal, their volumes are equal.

A. If then we can determine the area of the base of any prism, and the altitude of the prism, we know the volume of the prism.

M. Yes; it is equal to the volume of a rectangular parallelopiped on an equal (rectangular) base, and of the same altitude.

A. Can we not represent the volume of any prism by a cube, as we can represent the area of any rectilinear figure by a square?

M. No: the general problem "*Determine the side of a cube which shall be equal in volume to a given parallelopiped*" is not solvable by the geometry of the line and circle.

(*To be continued.*)

At a meeting of the Anthropological Institute, on March 10, Mr. James G. Fraser read a paper on "Certain Burial Customs, as illustrative of the Primitive Theory of the Soul." The Romans had a custom that when a man who had been reported to have died abroad returned home alive, he should enter his house, not by the door, but over the roof. This custom (which is still observed in Persia) owed its origin to certain primitive beliefs and customs with regard to the dead. The ghost of an unburied man was supposed to haunt and molest the living, especially his relatives. Hence the importance attached to the burial of the dead, and various precautions were taken that the ghost should not return. When the body of a dead man could not be found, he was buried in effigy, and this fictitious burial was held to be sufficient to lay the wandering ghost, for it is a principle of primitive thought that what is done to the effigy of a man is done to the man himself. The Director read a paper by Admiral F. S. Tremlett, on the "Sculptured Dolmens of the Morbihan" (North-west France). About eighty sculptures had been found, invariably on the interior surfaces of the cap-stones and their supports. It is remarkable that they are confined within a distance of about twelve miles, and are all situated near the sea-coast, beyond which, although the megaliths are numerous, there is a complete absence of sculptures. The sculptures vary in intricacy, from simple wave-lines and cup-markings, to some that have been compared to the tattooing of the New Zealanders.

THE INTER-OCEANIC SHIP RAILWAY.

(*Continued from p.* 219.)

As said before, the road is designed to be almost exactly straight, since there will be no curves having a radius less than twenty miles, for the carriage is 400 ft. long, and rests upon wheels which, as already explained, are not set

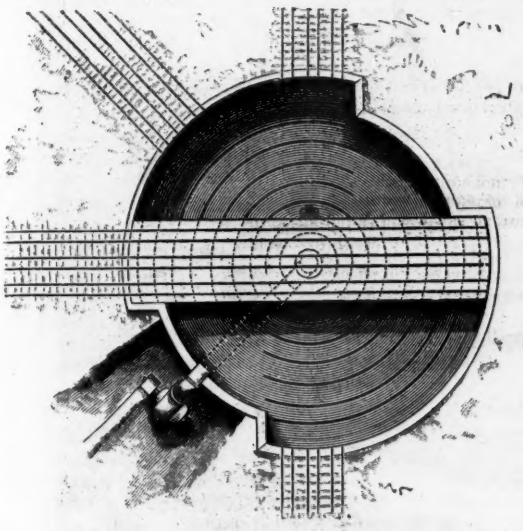


Fig. 7.—Plan of Floating Turntable.

on trucks swinging to a common centre. There are only five places in the whole line where it is necessary to deviate from a straight line, and at each of these places a floating turntable (see Figs. 7 to 9) will be built. These turntables in design resemble pontoons, for they rest upon water, and will be strong enough to receive the carriage and its burden. The turntable pontoon will be firmly grounded upon the circular bearers of the basin, when the carriage is run upon it, by the admission of water. This is pumped out by a powerful centrifugal pump, the water being drawn through the cylindrical pivot of the pontoon, which is hollow, and discharged into the basin. When the pontoon has been made sufficiently buoyant to be turned easily upon its pivot by steam-power, the ship carriage is then quickly pointed in its new direction. The valves then permit the water to enter once more, and the pontoon table again rests upon its bearings. These turntables may be made to serve another purpose: by their means a ship can be made to run off on a siding, so to speak, where she can be scraped, painted, coppered, caulked, or otherwise repaired without removal from her cradle, and thus be saved the heavy expense of going on a dry-dock.

The locomotives for hauling the ship carriage over the Isthmian railway will not differ from those in ordinary use. The big freight engines of the day have no difficulty, as we know, in drawing freight trains of a total of 2,000 tons; and, as the ship carriage moves along three tracks, it would be easy, if such a course were necessary, to place three locomotives in front of it and three behind. The time estimated in crossing from ocean to ocean is only sixteen hours.

The cost of the ship railway, as computed by expert engineers, will be about $60,000,000, or $75,000,000 at the outside.

A careful estimate has shown that it would not be unreasonable to look for a gross tonnage of 5,000,000 tons in 1888 for any passage across the Isthmus. Four dollars the ton would be but a moderate charge—the Panama railroad demands fifteen dollars a ton: this would give $20,000,000 as gross receipts. Now, it has been estimated that 40 per cent. of this would pay all working expenses, thus leaving $12,000,000 as net profit, or 12 per cent. on a capitalisation of $100,000,000.

The Tehuantepec ship railway is a private enterprise that does not ask a dollar from the Government, and there will be little trouble in its construction if the Government does not, by legislation or by committing itself to the Nicaragua Canal scheme, injure its prospects and defeat its aim, which is to furnish a cheap, rapid, and safe passage for ships across that narrow strip of land which heretofore has proved an effectual barrier to aspiring canal builders.

If Mr. Eads' plans are not thwarted, there is reason to believe that ere long the graceful masts and trailing yards of majestic ships will be seen to mingle with tropic palms in the mountain fastnesses of the Cordilleras, on the ship railway.

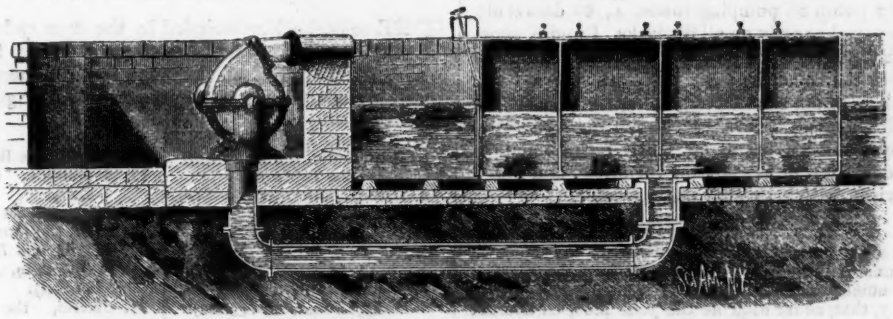


Fig. 8.—Sectional View of Floating Turntable.

In our illustrations, Fig 2 shows an elevation of the adjusting of the screw standard for supporting the vessel on the pontoon, the detail of these standards being given in Fig. 5. A is the standard, having a head-plate with universal joint, its top cushioned with rubber or canvas, to prevent damage to the ship; B is an adjusting nut, which, when the rams are down, stops the descent of the jack by contact with the top side of the main girder C, on which they will rest, D being the top of the hydraulic jack of the pontoon, the number of these jacks used being better shown in Fig. 4, a perspective of the floating pontoon. E F G, in

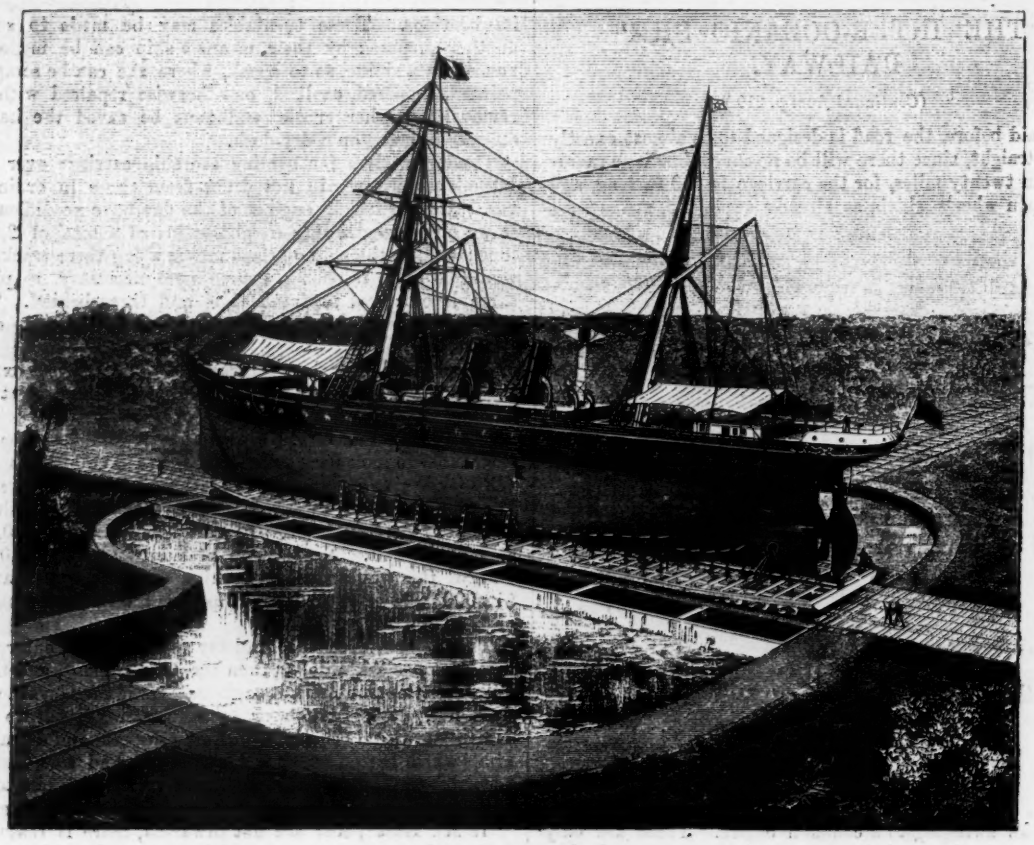


Fig. 9.—The Floating Turntable.

Fig. 3, show the sectional girders by which the weight of the vessel is distributed on the jacks. H shows one of the upper pontoon sections. J shows an arrangement in connection with the pump on pumping tower, L, to distribute the load of the vessel equally on all the jacks. I and K show the arrangement by which the water is exhausted from the pontoon. On each side of the basin there are several rods, on top of which are nuts capable of holding the pontoon, to prevent its rising above the level of the railway when the ship and cradle have been taken off. Fig. 7 and 8 show a plan and sectional view of the floating turntable, and Fig. 9 a perspective view, with a ship on the turntable.

In connection with an assertion in the first part of the article on "The Inter-Oceanic Ship Railway" (reproduced from the *Scientific American* in our number of March 6), it is pointed out, on indisputable authority, that, as far back as the year 1856, M. Laurent Stéger projected a Ship Railway from Marseilles to Calais. It was part of M. Stéger's design that the ship's own engines should be utilised in accomplishing (wholly or partially) the transit.

In a lecture delivered by Mr. Howes, at the Royal Victoria Hall, on the 10th inst., on "The Smallest Living Things," it was pointed out that some of the organisms are not more than ·000001 inch in length, and that the bacillus, spirillus, bacterium, &c., multiplying by continual subdivision, are so (practically) infinitely numerous as to be present everywhere that the air can penetrate. The lecturer further showed from their mode of digestion that they must be animals, not vegetables. In order to illustrate the necessity for the access of germ-laden air to cause putrefaction, two flasks of chicken broth were exhibited, made seven years previously. One had been sealed from the air, the other exposed to it for ten minutes a few days previously. The latter was thick and muddy from the swarms of bacteria it contained; the former as clear as on the day when it was made.

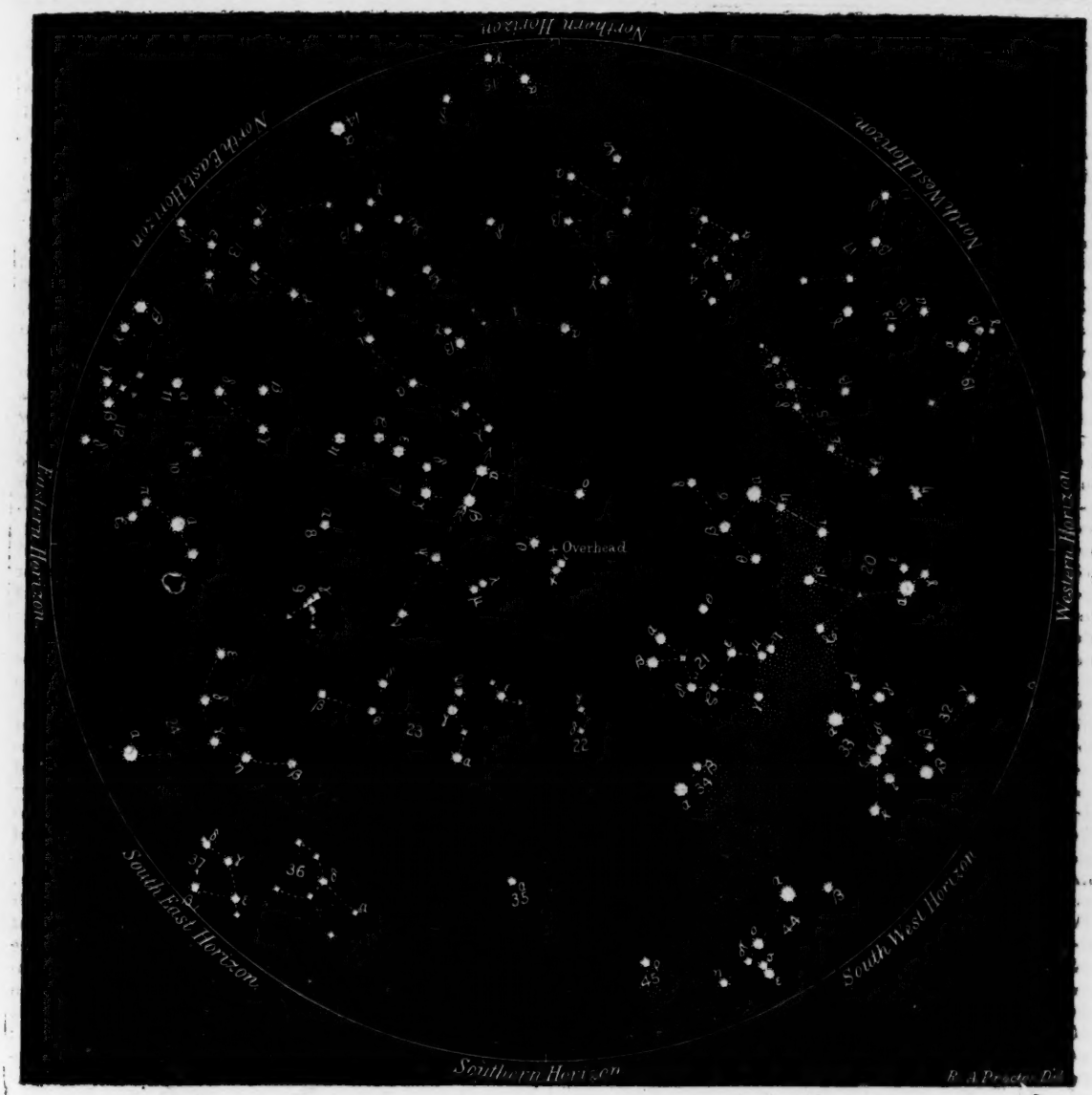
FIRST STAR LESSONS.

By Richard A. Proctor.

THE constellations included in the twenty-four maps of this series are numbered throughout as follows (the names being omitted on the maps, to clear these as far as possible from all that might render the star-grouping less distinct):—

1. *Ursa Minor*, the *Little Bear* (*a*, the *Pole Star*).
2. *Draco*, the *Dragon* (*a*, *Thuban*)
3. *Cepheus*, *King Cepheus*.
4. *Cassiopeia*, the *Lady in the Chair*.
5. *Perseus*, the *Champion* (*β*, *Algol*, famous variable).
6. *Auriga*, the *Charioteer* (*a*, *Capella*)
7. *Ursa Major*, the *Greater Bear* (*a*, *β*, the *Pointers*).
8. *Canes Venatici*, the *Hunting Dogs* (*a*, *Cor Caroli*).
9. *Coma Berenices*, *Queen Berenice's Hair*.
10. *Boötes*, the *Herdsman* (*a*, *Arcturus*).
11. *Corona Borealis*, the *Northern Crown*.
12. *Serpens*, the *Serpent*.
13. *Hercules*, the *Kneeler*.
14. *Lyra*, the *Lyre* (*a*, *Vega*).
15. *Cygnus*, the *Swan* (*a*, *Arided*; *β*, *Albireo*).
16. *Pegasus*, the *Winged Horse*.
17. *Andromeda*, the *Chained Lady*.
18. *Triangula*, the *Triangles*.
19. *Aries*, the *Ram*.
20. *Taurus*, the *Bull* (*a*, *Aldeburan*; *η*, *Alcyone*, chief *Pleiad*).
21. *Gemini*, the *Twins* (*a*, *Castor*; *β*, *Pollux*).
22. *Cancer*, the *Crab* (the cluster is the *Beehive*).
23. *Leo*, the *Lion* (*a*, *Regulus*).
24. *Virgo*, the *Virgin* (*a*, *Spica*)
25. *Libra*, the *Scales*.
26. *Ophiuchus*, the *Serpent Holder*.
27. *Aquila*, the *Eagle* (*a*, *Altair*).
28. *Delphinus*, the *Dolphin*.
29. *Aquarius*, the *Water Carrier*.
30. *Pisces*, the *Fishes*.
31. *Cetus*, the *Sea Monster* (*o*, *Mira*, remarkable variable).
32. *Eridanus*, the *River*.

[*Continued on next page.*



NIGHT SKY FOR MARCH (First Map of Pair),

Showing the heavens as they appear at the following hours:—

March 1 at 10½ o'clock.	March 8 at 10 o'clock.	March 16 at 9½ o'clock.
March 5 at 10¼ o'clock.	March 12 at 9¾ o'clock.	March 20 at 9¼ o'clock.

33. *Orion*, the *Giant Hunter* (*α*, *Betelgeux*; *β*, *Rigel*).
34. *Canis Minor*, the *Lesser Dog* (*α*, *Procyon*).
35. *Hydra*, the *Sea Serpent* (*α*, *Alphard*).
36. *Crater*, the *Cup* (*α*, *Alkes*).
37. *Corvus*, the *Crow*.
38. *Scorpio*, the *Scorpion* (*α*, *Antares*).
39. *Sagittarius*, the *Archer*.
40. *Capricornus*, the *Sea Goat*.
41. *Piscis Australis*, the *Southern Fish* (*α*, *Fomalhaut*).
42. *Lepus*, the *Hare*.
43. *Columba*, the *Dove*.
44. *Canis Major*, the *Greater Dog* (*α*, *Sirius*).
45. *Argo*, the *Ship*.

The Prince of Wales, President of the International Inventions Exhibition, has fixed Monday, May 4, for the opening of the Exhibition.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

XIX.—THE FRAMEWORK OF THE DWELLING-HOUSE.

STRUCTURAL EXAMPLES (*continued*).

THE DISPOSAL OF HOUSEHOLD REFUSE.

In our last issue we alluded to the "Goux-Pail" system as an attempt to deal with both solid and liquid waste products. It is but right to mention here that that method is perhaps the highest development which the pail system has reached; it is a direct improvement upon the

"midden" type, and totally distinct from the carbon, earth, and ash "closet" types, which are independent and original methods for dealing with excrementitious waste, apart from other refuse.

It may be well here for us to adopt an unequivocal nomenclature; for we find, even in the works of eminent sanitary officers, so much confusion through the lax usage of otherwise clearly definite terms, that a great deal of misapprehension is apt to arise therefrom. By the name "midden" we shall henceforth designate heaps, or receptacles full of indiscriminate rubbish, such as mixtures of garbage, dust, excreta, &c. The word "closet" we shall use exclusively for apparatus designed especially for the disposal of excreta, apart from garbage and cinder refuse. The importance of this distinction will at once become obvious; for, it may be pointed out that the midden process can never become perfect, on account of the obstacles presented in large pieces of decaying matter, or the introduction of such huge particles as pieces of cinders, bones, shells of molluscs, &c., which prevent the reaction of suitable correctives, such as dry sifted earth, powdered carbon, soot, or sifted ashes, by not permitting them to come into that intimate association with the decaying matters which is so necessary for their effective treatment. To the violation of this principle must be attributed much of the adverse criticism on the value of dry earth, and particularly of ashes; for, in the former case, clods of earth, and in the latter instance, large cinders, vitiate what would otherwise be an excellent result.

It may be interesting to some of our readers to know exactly how the midden system, and its direct descendant, the pail system, arose; we confidently hope that they will soon become things of the past. As late as 1869, the state of affairs in the midland counties of England, the seat of the origin and growth of this system, was in a most deplorable condition. In his report for that year to the Privy Council, Dr. Buchanan says:—"At present it is common to find" (in Birmingham) "huge, wet, fœtid middens, uncovered, undrained, unemptied, some of them as deep and big as the foundations of an ordinary cottage. Few of them are covered, the inspector of nuisances thinking they are better left open. Many are under workshops, where work is done amid stench all the year round, and among swarms of flies in the summer." In Nottingham a decided improvement upon the above shows the next stage admirably. A huge pit, about 80 cubic feet in size, rounded at the bottom, and lined with cement, formed the receptacle, which was cleared out quarterly; two privies opened into this pit laterally from above, whilst side doors admitted the garbage and ashes, &c.; a back doorway to the pit afforded access to the scavenger, and the whole was sheltered from the rain by a suitable superstructure. In spite of the introduction of garbage and cinders into these middens, the parts covered by the ashes were deodorised; but, nevertheless, the stench from the more or less exposed parts was simply abominable. In Hull the midden is somewhat better; it is limited in size to the space beneath the seat, and is entirely above the level of the ground; the bottom of the brick-built receptacle is paved, and slopes slightly from before backwards; the garbage and fire refuse is thrown in through the orifice of the seat.

The Nottingham midden has now, to a considerable extent, given place to the Nottingham tub, and thus insensibly passed into the pail system. It is nevertheless very defective, and has led to a great deal of unnecessary labour, for the Nottingham authorities are obliged to make provision for very perfect yard drainage, to offer every facility for the removal of household slops other than liquid excreta, and to enforce, to the utmost of their power, strict observance of their rules and regulations. Even amidst all these precautions the system is a failure, inasmuch as the corrective re-agent—ash-dust in this case—is not freed from the large particles or cinders; and garbage, &c., is permitted to aggravate the nuisance. A stage beyond this, and we come to the Goux pail, adopted by the town of Halifax, whilst a retrograde step is to be found in the hermetically sealable Haresceugh's patent spring-lid receptacle of Rochdale, and the Birmingham pail. Both of the last-named forms are not, strictly speaking, middens, but they are, without doubt, direct developments therefrom, and are links which unite that system to the essentially modern and rational dry-closets, two forms of which, the earth and the carbon, we have already noticed.

The problem of how to deal adequately with liquid waste has been one of the most difficult to solve by the advocates of the dry-closet system. In our last issue, we showed how this could be done by using the carbon-closet. With regard to the earth-closet, we cannot do better than quote a portion of a letter recently addressed to us upon this subject by our valued subscriber, E. D. Girdlestone, Esq., B.A., of Clifton. He says:—"Touching the earth system, I mention in my pamphlet* that the dry-earth system prevailed at the 'West of England Sanatorium,' near Weston-super-Mare. (It has lately been given up, owing to the land being almost entirely sea-sand, and, consequently, unsuitable for coalescing with excreta.) But, when it was in use, besides having Moule's Earth Closets for the use of both sexes, we had, for the men, "urinals" of the most simple description devised by myself—viz., square, open, galvanised iron boxes, painted, and on wheels, fitted with handles like wheel-barrow handles. One of these boxes was filled two-thirds full with dry earth, and placed in a shed; and then, when the earth had become sufficiently saturated from the men using it as a urinal, it was wheeled into the garden, and the contents put, with the contents of all the earth-closets, into trenches dug for their reception, and roots were planted, such as potatoes, radishes, beets, &c. Further, the housemaid going into a dormitory, took with her two slop-pails; one of them, A, for the reception of the chamber utensil contents; and the other, B, for the bath and basin water; then A was emptied into an earth-box, like the urinals described above, which stood in the yard, and B was emptied down a sink which also received the scullery water. The sink led to a tank in the garden; some of the water travelling there oozed through the drain-pipes into the earth, and what reached the tank was from time to time used, having been first deodorised, for irrigation. In that way every particle of solid and liquid excreta and of waste water was utilised."

There can be no doubt that Mr. Girdlestone's method is a very valuable one for country houses, and even for suburban dwellings with gardens; but in large towns, and for the dwellings of the poor in all parts where the allotment of land is confined to a small back-yard, other plans must be employed in order to perfect the dry-closet system. In our next communication we shall give the details of those methods.

Coventry Sewage.—The Town Council of Coventry have decided to considerably enlarge the sewage works of their city to meet increase in population, and have instructed Mr. Melliss to carry out the work. The sewage of Coventry has been for the last ten years dealt with by a combined system of chemical precipitation with filtration through land, and the operations have given general satisfaction.

* "Our Debt and Duty to the Soil."

Editorial Gossip.

THE Zodiacal light has been very bright, though with an abnormally ill-defined outline, on every clear evening, after sunset, for the last week or two.

EVERYONE concerned for the advancement of that scientific knowledge which is so pre-eminently power; everyone who regards the life of a human being as of infinitely greater importance than the temporary suffering of a dozen rabbits or guinea-pigs; everyone, in short, unprepared to swallow camels of portentous size, while scrupulously straining at gnats of the most microscopic dimensions, must rejoice at the defeat of bigotry and fanaticism at Oxford on Tuesday week, when, as the result of their almost superhuman exertions, the anti-vivisectionists contrived to muster 244 votes in opposition to the 412 given by the advocates of humanity and of the progress of physiological science. There is nothing so offensive as cant, be it religious, social, literary, scientific, or political, and probably as much of it has been uttered in connection with this question of vivisection as in that of any one which has recently agitated the public mind. That, to take a single illustration, unnumbered thousands must have died of aneurism but for John Hunter's experiments upon live animals, weighs as nothing with those whose real hatred of science is clothed in the garb of sickly sentimentality. Had we nothing but the action of the party which has just been so ignominiously defeated at Oxford to guide us, it might well be imagined that Dr. Burdon Sanderson was a mere callous brute, whose business and delight at once it was to cut and carve living domestic animals daily on his lecture-table, invariably and studiously avoiding the use of anæsthetics; instead of a physiologist of European reputation, whose kindness and tenderness of heart will not suffer in comparison with those of the most blatant of his opponents in the Sheldonian Theatre. I suspect, though, that, as I have said, hatred of science altogether was at the bottom of no little of the opposition offered, by men who regard their Alma Mater as a mere "grinding" house to turn out by the hundred those pass-men who form the average curates with whom we are afflicted; and as a means of providing Fellowships for the comparatively few of superior mental endowments who can render "Sing a Song of Sixpence" into Alcaic metre, or give a bran-new reading of some fragment of Theognis. *Stare super vias antiquas* is (as Mrs. Gamp so impressively said) their "mortar which they sticks to." Construing, indifferent verse-making, and "Aldrich" served their fathers. Why should a new generation ask, like Oliver Twist, for more?

IT is just 158 years to-day since one of the greatest men that England—or, in fact, the whole world—has produced, passed over to the majority; for on March 20, 1727, died Sir Isaac Newton, at Kensington.

THE recent considerable fire which has occurred in Oxford-street, and the great exertions and very large amount of engine-power required to subdue it, afford a striking illustration of the small progress which science has enabled us, so far, to make in overcoming conflagrations of any magnitude. Since the construction, about 1684, of an engine with an air-chamber to protect the library of Louis XIV., no real advance has been made in this direction. Of course, increased power has been obtained, but we still run in the old groove, and trust to flooding our burning structures with a sufficiency of water to extinguish the fire (such sufficiency, of course, depending largely on the nature of the inflammable material to be quenched). A piece of apparatus which I have seen, called, I fancy, "L'Extincteur," appears to be a move in the right direction; but the only specimen that has come under my personal observation was far too small to cope with anything more extensive than an incipient blaze in a room. Surely, in days when chemistry is so hideously perverted for the destruction of human life, it may reasonably be asked if she is impotent, in this direction, to help to save it?

Reviews.

SOME BOOKS ON OUR TABLE.

Wood-Carving. Edited by FRED. MILLER. (*Wyman's Technical Series.*) (London: Wyman & Sons. 1885.)—That art to which we are indebted for the glories of the choir-stalls, rood-screens, and episcopal thrones in the grandest of our old cathedrals, which adorned the halls of the mediæval nobility, the great ecclesiastical corporations and the civic guilds, the art of carving in wood, had gradually fallen into comparative desuetude when the so-called "Gothic revival" resuscitated a taste for a means of decoration so obviously in accord with it, and created a demand which, for a time, could scarcely be adequately supplied. And, speaking now more particularly of its application to ecclesiastical adornment, when the supply did come, alas! it was largely in the form of machine-made ornament; bosses by the thousand, finials by the hundred, and eagles for lecterns by the score, being turned out all precisely alike by mechanism. How far these productions merit the name of art, it needs but small scrutiny to discover. Not a feather on the wooden eagle is out of place, but he is a very wooden eagle indeed for all that. The ancient craftsman did produce artistic work, because he put his whole heart into it, and a framework with rapidly-rotating drills has no heart to put there at all. Happily, though, there is a pretty rapidly increasing public who are not content with merely conventional automatic productions, and latterly wood-carving has become a more or less fashionable amusement. To all who wish to pursue this charming recreation Mr. Miller offers himself as a guide, philosopher, and friend; and assuredly the careful study of his book, coupled, of course, with adequate practice, will enable the least-enlightened tyro to acquire no mean proficiency as a wood-carver. The instructions given are as plain and detailed as they can be, and the forty-seven illustrations leave nothing to be desired. Every beginner and moderately advanced student in the art of wood-carving should obtain Mr. Miller's book straightway.

An Analysis of the Principles of Economics (Part I.). By PATRICK GEDDES. (London: Williams & Norgate. 1885.)—That there is an empirical art of economic statistics is, of course, a mere truism. That anything worthy of the name of a science of economics exists may be gravely doubted, and it is to lay the foundation of such a science that Mr. Geddes's work is written. The physical and psychological principles upon which that science must of necessity be based are here set forth, and the bearing of the doctrines of evolution, the conservation of energy, &c., upon the methods of investigation is developed and insisted upon. It is impossible to give even a précis of the author's chain of reasoning here. All interested in the subject on which this work treats, should obtain and read it.

What the Boy Thought. (Second edition.) (London: W. Swan Sonnenschein & Co. 1884.)—This *brochure* consists of a series of the imaginary utterances (many of

them amusing enough) of a small boy, who (like Mrs. Wititterly in "Nicholas Nickleby") "forms and expresses an immense variety of opinions on an immense variety of subjects." Grown people may read some of the good-natured satire in this tiny book not wholly without profit.

Harbours and Docks. . . . . By Leveson Francis Vernon-Harcourt, M.A., M.I.C.E. Clarendon Press Series. (London: Henry Frowde. 1885.)—A mere glance at that ghastly annual record, the "Wreck Chart of the British Islands," must convince every one of the paramount importance of constructing harbours of refuge and breakwaters in all exposed and dangerous parts of the coast, and of the maintenance of lighthouses, beacons, and buoys in the highest state of efficiency. That preventible loss of life occurs year after year from national neglect in this respect it will be hard to deny, and those who are concerned for the very existence of the brave men upon whom England's greatness so largely depends, must perforce feel an earnest interest in the work whose essential principles are explained in the book before us. For Mr. Harcourt, in his two volumes (one of the text, the other of its illustrative plates), has given us what is practically an encyclopædia of all that pertains to the construction and maintenance of harbours, docks, and breakwaters; as well as of buoys, beacons, and lighthouses. To the library of the civil engineer, "Harbours and Docks" will form an indispensable addition. To the shipowner and mercantile man it will convey a mass of information on subjects in which his stake is of the heaviest; while the general reader will gather from these volumes ideas as novel as they are interesting of the principle involved and the mechanical appliances employed in the construction of harbours, docks, lighthouses, breakwaters, and every cognate work on which the safety of our shipping depends. Deprived of docks and artificial harbours, British commerce must be hopelessly crippled, even if it did not come to an end altogether; while the already too numerous "accidents" to shipping would be increased and intensified one hundredfold were the present lights, buoys, and beacons controlled by the Trinity House, by catastrophe or design to disappear. Hence the value of the work before us. To attempt anything like a *précis* of its contents here would be impossible. We must refer the reader to the book itself to discover how thoroughly Mr. Harcourt deals with every branch of his subject. Perhaps no better idea of the conciseness, combined with adequacy, of our author's treatment of details could be obtained by the non-professional reader, than that to be derived from a perusal of his description of the making of the harbour and breakwater at Newhaven (pp. 343 346), and following that perusal up by a visit, by the Brighton Railway, to the works now in progress there. There is not a superfluous word in the description, which is as short and simple as need be; but by reference to the plans, and to other parts of the book explaining the use of concrete, &c., the reader who will go and view the work in course of construction will find how thoroughly apprehensible Mr. Harcourt has rendered it, and how intelligently he has enabled the beholder to appreciate it. "Harbours and Docks" is worthy of the series in which it appears. We need say no more.

Geographical Reader. By J. R. Blakiston, M.A. (London: Griffith, Farran, Okeden, and Welsh.)—Primarily intended as a reading-book for "Standard VII.," Mr. Blakiston's book is really too good to be rendered aloud in the parrot-like gabble of a public elementary school. For the boy or girl who will study this little work with moderate attention will find that he (or she) has acquired no mean knowledge of what is called, in South Kensington slang, "Physiography." The physical geography of the sea, its tides, currents, and natural history are all dealt with, as are its waves, colour, and saltness. There is a chapter on buoys, lighthouses, and lightships, and others on maritime adventures, diving, volcanoes, earthquakes, &c.; while Arctic exploration concludes the geographical part proper of the book. The second part deals in a lucid way with familiar astronomical phenomena. Coloured physical maps and astronomical diagrams are given by way of illustration. This is an honest little volume, imparting a greater amount of sound information on the subjects of which it treats than some far more pretentious ones.

Timber. No. 1, Vol. I. (London.)—This first number of a magazine devoted to the timber trade contains an immense amount of information valuable to all concerned in the purchase or use of the material from which it takes its name. It seems to be amusing in addition—a by no means universal attribute in a "trade" journal.

Sunday Bits. No. 1. (London: Dale, Reynolds, & Co.)—Here is a new departure in the literature of the first day of the week, and, judging from its opening number, a very manifest improvement on such of its predecessors as we are familiar with: for it is not only instructive, but really amusing, and supplies no small amount of reading which the younger members of the family will be tempted and attracted (instead of being ordered or requested) to peruse. Why so-called "Sunday reading" should, *ex necessitate*, be entirely solemn, serious, and dismal we never could imagine. The second title of the paper before us, "An Unsectarian Journal of Entertaining Christian Literature," fairly epitomises its contents.

The Family Doctor. No. 1. (London: George Purkess. 1885.)—There is a good deal in this publication which will be found useful to those suffering from slight ailments, and who may be content to dispense with professional aid. Invalid cookery, nursing, hygienic bootmaking, freaks of nature, hospital reports, poisons and their antidotes, and elementary anatomy and physiology, form the subjects of separate chapters. In addition to all this, we have the first instalment of "A Dictionary of Diseases," a column of jokes (presumably to enliven convalescent patients), and a sensation novel! Truly an astonishing pennyworth.

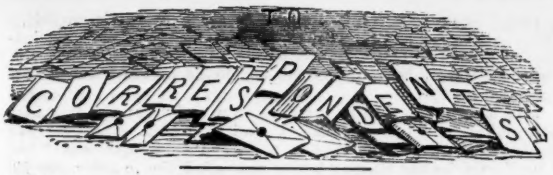
We have also on our table *Bradstreet's*, *Le Franklin*, *Ciel et Terre*, *Medical Press and Circular*, *Proceedings of the Geological Society*, *Wheeling*, *Society*, *Journal of Botany*, *The American Naturalist*, *The American Eagle* (devoted to the projected American Exhibition in London in 1886), *The Tricyclist*, *Journal of the New York Microscopical Society*, and the *Office Calendar for* 1885 (from Alfred Boot & Son).

The first part of a new serial issue of "The Family Physician, a Manual of Domestic Medicine by Physicians and Surgeons of the principal London Hospitals," is to make its appearance on the 26th inst. The work has already gained an established reputation as a sound and reliable guide for family use.

Mr. Richard Jefferies has been engaged in writing a new work, entitled "After London, or Wild England." The first portion of the book is named by its author "The Relapse into Barbarism," the second part "Wild England." Messrs. Cassell & Co. will be the publishers.—*Athenæum.*

In consequence of a heavy fall of snow it became impossible to lower 150 arc lamps at Dayton, in Ohio, to renew the carbons, and hence there was no light for three evenings.

At Kirkwall, on Sunday night, there was the finest display of Aurora Borealis, or Northern Lights, that has been witnessed there for many years. About 9.30 they were at their brightest, and one could have read a book at times. The whole northern sky was illuminated, and a beautiful band stretched from the horizon in the east across the zenith to the horizon in the west, while the streamers were shooting forth like rockets in all directions, and the different colours blending together made the sight very imposing. The barometer has fallen briskly since Sunday morning, and on Monday was still falling, with a strong gale from the south-west, accompanied with heavy showers of rain.



"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

FERTILITY OF JEWISH MARRIAGES WITH CHRISTIANS.

[1639]—With reference to the curious assertion made by Mr. Jacobs, and reported on page 188 of KNOWLEDGE, will you allow me to state the following less curious facts?

Of those Jews with whose history I am sufficiently acquainted, ten are married to ladies of their own race, two to Christians (English). Of the former, seven have from two to eight children each; three have none. Both the mixed marriages were fertile, four remarkably well-developed boys and seven handsome girls being at this time alive to testify to this fact. WAHRHEIT.

INSCRIBED ROCKS.

[1640]—As to these (1619) there are a great many in Northumberland, about which a good deal appeared in the *Newcastle Weekly Chronicle*, in (I think) 1879 or 1880. As I have not seen them, I shall not express any opinion, but shall be glad of an opportunity to record what I know about one here (Pornic).

In 1875, a tumulus with Megalithic chambers was opened at the expense of the Antiquarian Association of the Department (Loire Inférieure), under the personal superintendence of one of its members, Baron de Wismes. In 1876, I came here in the early summer, and spent many days in this and other Megalithic remains. In the one opened the previous year I was attracted by apparent

inscriptions on an upright block of red sandstone (sketch subjoined). On one was a cross, another like a small *pi*. I certainly took them for hand-work, till I found in the two lower ones proof positive that they had all been done by the stems of some shrub. The filaments of the stem were, *in situ*, as regular as herring-bones (I scraped some out, and have preserved them); there then came very hot weather which dried them to tinder, then weather which washed them out.

When Baron de Wismes came here in August, 1876, I showed him the marks. He was rather vexed at not having noticed them himself, but would not hear a word as to the shrub hypothesis. He made beautiful drawings of them, and wrote a "Mémoire," which he read at an archæological congress at Presburg (Hungary) that year. Thereon I wrote to the *Academy* (since the Baron assured me the world was excited at this, the only known case of inscriptions on megaliths), briefly stating the above facts, declaring that it was as much an antiquary's mare's-nest as the "A.D.L.L." of Monkbarns, or the

B.I.L.S.T.
U.M.P.S.H.I.
S.M.A.R.K.

of Mr. Pickwick, and signing my name. The *Academy* took no notice of my letter. It therefore is an accredited fact that there is *one* proof that the rude savages who built these refuges had cutting instruments, and traced characters. *Victrix causa Diis placuit, sed victa Catoni.* (My father was a midshipman with Sir John Ross in 1818-19, and with Parry in 1820-21, and he used to say that much of the landscape (notably the Croker Mountains) sketched by Sir J. Ross had no existence, but was clouds.)

I suppose the plant which ate these channels in the stone must have been ivy. I am puzzled to account for its growing in darkness, as it must have done. The stems were probably torn away by the Baron's own workmen. I have dug down, but the roots are not to be found; whence I conclude that the stems ran along the ground until they met the stone, then climbed up it. The curve they take a little way up is at once explained on inspection. The stone just above each juts out; they turned away to avoid it. The marks are always on a higher plane than the rest of the stone; the stems, no doubt, bridged over the hollows without disintegrating the stone.

I inspected the stone afresh yesterday, and must own that *now*, as for years past, the channels have all the appearance of human work. Had I not found the delinquent rootlets actually in them, I should not have dreamed of any other origin.

The spirals [in 1619] may have had the same origin. But also they may not. There are stones so inscribed in Switzerland which are said to be rude maps of the neighbouring country. The stone I have written of is between four and five feet high.

HALLYARDS.

[It struck me, on looking at Mr. McMeister's illustration to his letter [1619], on p. 181, that the markings strongly resembled sections or impressions of univalve fossil shells.—ED.]

DUALITY OF THE BRAIN.

[1641]—I woke one night, having just dreamed a situation in which I was addressed in a sequence of heroic verse as the *bard* who had made Odysseus—

"*Knight* of his rocky Isle."

In some way I recognised that the allusion was to my having given the title "Sir" to Odysseus in translating, a few days before, the interview between Odysseus and Achilles in Hades. Odyssey xi. 486. Thus:—

"A truce to consolation, Sir, he said,
I'd rather be a hind for what he'd give
To some poor churl who scarce has means to live,
Than reign in Hell the King of all the dead."

Here "Sir" stands for "*φαίδιμ*" *Ὀδυσεῦ*.

I just gave so much thought to the manner of rendering as to decide that it should not stand; and so dismissed it from my mind. When, lo! it pops up again in this comical manner in a dream some days after!

I suppose we have all of us been sometimes surprised by dream-thoughts or suggestions that do not belong to our waking personality; sometimes with a positive and disagreeable antagonism.

Does not the duality of the brain suggest some light on this phenomenon? Does it not at least suggest that the two sides of the brain can even play at being *two persons* within us?

Here we are met by a conception antecedently quite inapprehensible: Duality of persons in one individuality. Nothing can be more certain than that we feel ourselves to be *one*. Yet it is coming out with more and more certainty from the line of observation and thought you have been pursuing, that this oneness is perfectly consistent with a fundamental duality.

LEONARD H. RUDD.

GROWTH OF THE HEAD.

[1642]—Whom *can* we believe? On p. 194 you quote Dr. Brown-Sequard as declaring that all heads increase in girth from the twentieth to the fortieth year, and that *his own hats*, unworn for *six months*, would always prove too small! Might not this be from shrinkage of the hat? Hats have a leather band round the head;

leather is contracted by heat; the head is hot. Here, then, is an evident origin of the contraction suggested. Besides, the hair may have been thicker in itself, or trebled in bulk, by pomatum, dust, &c. In the Tichborne trial, all the experts (hatters) swore that a man's head *never* increases after he is full-grown; and one of the strongest points in favour of the Claimant was that the helmet of the genuine Roger fitted him beautifully! I have a Glengarry bonnet made for me to measure thirty years ago which fits me now as well as then, though cloth waistcoats made twenty years ago are now too tight round the chest. HALLYARDS.

SEVERED HEADS.

[1643]—Having noticed several articles in KNOWLEDGE on the subject of severed heads, I thought the following, taken from the *Mirror* of 1836, would be interesting to your readers. It runs thus:—"Majou, Professor of Physiology at Genoa, having produced at Paris an investigation of the results of the guillotine, states that, having exposed the heads, a quarter of an hour after decollation, to a strong light, the eyelids closed suddenly; the tongue, which protruded from the lips, being pricked with a needle, was drawn back into the mouth, and the countenance expressed sudden pain. The head of a criminal named Tillier, being submitted to examination after the guillotine, turned in every direction from whence it was called by name. A report hitherto treated as fabulous, may, therefore, be believed—that when the executioner gave a blow on the face of Charlotte Corday's head, the countenance expressed violent indignation. Fontenelle asserts that he has frequently seen the heads of guillotined persons move their lips, and his memoirs contain many other apparently incredible, but equally authenticated facts. Siveling declares that by touching the spinal cord the most horrible demonstrations of agony succeed."

They don't mention *how* Tillier's head was enabled to turn round; and in the first case I should fancy the worthy Professor's *own* eyes must have been affected by the strong light.

PERSIFAL YEARSLEY.

HYDROPHOBIA IN WINTER.

[1644]—I can quite confirm, from my own painful experience, the truth of your remark, on p. 177, respecting hydrophobia not being confined to the "dog-days." In the very bitter weather we had in the mid-winter 1879-80, my little dog was snapped at, whilst walking with me, by a strange dog. Only a very tiny scratch on his nose was made, and scarcely a drop of blood followed; but the manner of the strange dog was so peculiar that I called a policeman's attention to it, and the dog, having also snapped at people in the village, whose thick clothes fortunately protected them, was killed at once. I requested our veterinary surgeon to make a *post-mortem* examination, and the appearances were such as to leave no doubt on his mind that the dog was suffering from "rabies." The hardly-perceptible scratch on my little dog's nose was cauterised immediately; he was kept carefully secluded, under my own eye, and the veterinary saw him occasionally. For five weeks he continued in perfect health and spirits, and we began to hope he might escape, but on the thirty-seventh day very peculiar symptoms appeared, not of "hydrophobia," strictly speaking, as the poor little fellow lapped water to the last, but the tone of his bark altered strangely, his jaw drooped, and the remarkable change in his manner showed that he was "going out of his mind," if I may use the phrase; there could be no doubt that, slight as the wound was, he had been fatally inoculated with the virus. It would have been cruel, as well as very hazardous, to allow "dementia" to develop into "rabies," and my little pet's life was ended as mercifully as possible. Dogs may be more liable to go mad in very hot weather, especially if they have not free access to water, but that they may be attacked at *any* time of the year there can be no doubt. M. B.

THE TONE OF CONTROVERSY.

[1645]—Isaac Newton stated that the first mention of use of a celestial globe occurrs in the "Odyssey," vi. 100, sqq.; and that Nausicaa probably had it from the Argonauts, calling at Corcyra *en route* for Colchis; whence he pretended to fix the date of that expedition.

Had the illustrious man told this to me in private life, I should have complimented him in a tone of veneration; then added "There is just one circumstance which would make me hesitate. In line 115 the Princess throws the ball (*sphere*) in question *at* one of her maids. This seems improbable, had it been a celestial globe. I, therefore, d[illegible] feel clear that it was not a common game at ball which the [illegible]joyed, after dining, while the washed clothes were drying."

Had I been, however, writing, or speaking *in public* on this, I should have said, as Ernesti does, "This is a ridiculous hallucination;" dissenting entirely from a scholar who "blushes to print Ernesti's words, because Newton should be admired *even in his hallucinations*."

Men have ruled that in senate, forum, and press, the amenities of social life may be suspended, if desirable. Mr. Gladstone once compared Lord R. Churchill to a flea. I think this was "bad form," even for the House; but no one called him to order, nor did Lord R. protest.

The sole drawback that I see to the presence of ladies as members of deliberative bodies is that this rule cannot be observed in their case, and that men must not in future say that nonsense is nonsense.

Now, Sir Isaac Newton's puerile notion about Nausicaa is much more foolish (in my opinion) than anything in Miss Ballin's articles on "Thought and Language." I therefore in no way undervalued them, or her intelligence, *as a whole*, in protesting vehemently against an *à non causâ, pro causâ*—a scientific crime. And I expressly avoided naming her or her sex. But I erred, no doubt.

Mr. W. M. Williams thinks men could not live naked in temperate climates. It occurred to him that Cæsar, says our ancestors, actually did so. "Then," he says, "so much the worse for him. He is not credible." I stigmatise this as a literary offence. Instead of "Aut Cæsar, aut nullus," we have now "*Et* Cæsar, *et* nullus." I adduced many positive proofs that men can still live naked even in climates colder than Britain; and on p. 187 he pushes me aside with the following assertion:—"They merely show that the human body has great powers of *temporary* endurance of evil." *Temporary!* A girl who lived naked, day and night, for seventeen years, with never a full meal for the last twelve of them! and that is a fact *of the same kind* as "Chantry's oven or the vapour-baths of Nero!"

From his fallacious premiss he inferred (like Sir I. N.) that there could be no "missing links" in Europe. Why, Europe was not always temperate; surely the "missing link," had he been more delicate than the born Britons mentioned in letter 1627, could have lived where lions, tigers, hyænas, &c., did.

Weak health has always prevented me from being a student. I therefore take in KNOWLEDGE in order to take in knowledge, and am grieved if I find therein what my own experience rejects. Mr. W. M. Williams is an authority, and it is a pleasure to sit at his feet; nevertheless, I am glad (personally) that his will is not law, because he would extinguish me in at least three different ways: (1) By abolishing chimneys, without which I cannot sleep; (2) flesh-diet, without which I cannot live; (3) tea, without which I should have apoplexy (or chronic headache, as my mother had for forty years).

I, however, am "*vox et præterea nihil*." But, Cæsar! Of all the twenty-three wounds which finished him, none would surpass the pang caused by this last "unkindest cut of all"—that after twenty centuries a descendant of the Helvetians and Britons whom he crushed should rise up and say he was either *mendax* or *stultus* as to what he saw in Britain! HALLYARDS.

LETTERS RECEIVED AND SHORT ANSWERS.

E. D. G. Assuredly, I do not regard as an "intrusion" a communication which affords me an opportunity of reiterating the sentence at the head of the Correspondence Columns, "*The Editor is not responsible for the opinions of correspondents.*" The letters of which you (from one point of view not unjustifiably) complain were inserted simply on the principle *audi alteram partem*. That they are "the last" arises from the fact that they are so in sequence; and, in fairness, I decline to give disputants on either side one chance more than their opponents. It may well have occurred to the overwhelming majority of those who reason at all, "If these are the best arguments that those who advance them can adduce, their cause must be 'in a par'lous state'"—but I cannot conceive that it was my duty to say so, *totidem verbis*, in a footnote.—W. G. W. asserts that Williamson and Tarleton's "Dynamics" has been so carelessly read for the press that (*inter alia*) on p. 58, where W and W′ are used for the weights of the two masses in Atwood's machine, the equation for acceleration of one mass is printed $f = \frac{W - T}{W} g$, which should be (according to our correspondent) $f = \frac{(M - T)}{M} g$; that, again, on the same page, acceleration is given $f = \frac{W - W'}{W + W} g$, asking what are Wg $W'g$?" He goes on to say, "The following occurs on p. 100. 'The length of the seconds pendulum is found to be so many inches, hence the corresponding value of gravity is 32·1908 feet!'" [Why not? ED.] Further, that on "p. 47, 50 feet is given as the velocity of a body in Ex. 11." [But, as I am wholly ignorant of what this example

refers to, I am incompetent to form any opinion as to its correctness or incorrectness. ED.]—ROUPELL-PARK LITERARY SOCIETY. Received, unfortunately, too late to be of any use.—COMMENTATOR wishes to correct a misprint in his letter (1610) on p. 178. "The cause, the cause of soul," should be, "The cause, the cause *my* soul" (Othello, act 5, scene 2). He further complains that "but reason's growth" has not capital initial letters, and that I AM is not printed wholly in capitals.—WM. H. STONE. Returned with thanks. You seem to be unaware that a Commission was appointed in 1865, which exhaustively investigated the question of our British coal supply. See pp. 291 to 320 of "The Borderland of Science," by the Conductor of this journal.—A. E. W. The rubbers of a plate-glass electrical machine have conducting surfaces, and are connected by strips of tinfoil with the negative conductor. Arrears of matter have so accumulated (and continue to accumulate) that I can give no guess as to the date of appearance of any series of articles. A good deal on the subject appears in our earlier volumes. —REV. W. FITZGERALD. You may gather my own opinion of the letters to which you refer from my reply above to E. D. G., and I feel sure will not misinterpret my refusal to insert yours.—F. COMMON. It was my own obtuseness which prevented me from seeing that your letter was, in the words of the lamented Artemus Ward, "rote ironikle."—THOMAS AYERS. If you can separate solar light from heat in rays of the same refrangibility, you ought to be elected F.R.S. immediately (or sooner).—Will AN EARNEST THINKER kindly send his name and address to this office? A poem entitled, "The Blessed Hope" was left here endorsed "An Earnest Thinker," and I, perhaps not wholly unnaturally, took this to be a gift from the said "E. T." to myself. Now I get a letter from "Commentator" saying that *he* wrote the poem and sent it here *for* the "Earnest Thinker." If this is not a muddle, in popular parlance, "I'm a Dutchman!"—J. A. E. G. I hear of the instrument you speak of for the first time, and am utterly ignorant of its use. From your description it would seem to be a differential thermometer rather than, in any legitimate sense, a photometer.—W. K. KENNAN. The calculation of the details of the occultation of a fixed star by the moon for any given locality, with anything like accuracy, is most operose, and merely impossible to be popularised. You may, though, consult with advantage Mr. F. C. Penrose's description of his graphical method of approximately predicting this phenomenon, published by Macmillan & Co.—EDWD. A. TINDALL. It was the late General Shortrede who first called my attention to the fact that the contraction of a myopic pupil lengthens the sight. Being myself short-sighted I have experimented on this subject by interposing a card pricked with a pin-hole between my eye and objects utterly undistinguishable from being at too great a distance, with the result that the minute aperture enabled me to focus them fairly sharply, albeit the loss of light was enormous. This disposes at once of your idea that it is the mere increase in the amount of light passing through the pupil of a short-sighted eye that improves its definition. Surely you have some myopic friend upon whom you can experiment with a perforated card, and by watching his pupil as he reads a page successively indifferently and brilliantly lighted? Short-sight, I take it, arises from actual deformity of the eye-ball. —W. UPPERTON. Why not draw the "coal-sack" for yourself from Map XII. of the "New Star Atlas," by the Conductor?—A. F. OSBORNE. I exclude your logical and interesting letter with regret; but the discussion is now closed.—BARNARD THOMAS. Because of the very considerable perturbations she undergoes, and the irregularity of her orbit. Why it is not even a re-entering curve—in other words, at the end of a synodical revolution she is not in the same part of the sky as she was at the beginning of it. —E. L. G. Forgive me if I say that I cannot afford you the space here to air your fad about the production of geological changes by comets. Of course, we have run through comets (and shall do again) with as much, or as little, result as would accrue to you were you to walk out when a slight evening mist was rising. With regard to your benevolent efforts to instruct the Geikies, Ramsays, Lyells, &c., I would simply repeat the beautiful words of the poet:—

> "Teach not a parent's mother to extract
> The embryo juices of an egg by suction;
> That good old lady can the feat enact
> Quite irrespective of your kind instruction."—

R. OAKLEY. Do you seriously imagine that you will obtain admission solely on the merits of your inventions?—J. B. RUNDELL. I should prefer to wait until it has undergone the criticism of experts. —HENRY J. WRIGHT. Even were the discussion not closed, your letter adds nothing to the controversy, with its introduction of the exploded figment of a "vital force." It would be as sensible to speak of a "watch force" as a distinct entity. On receipt of a stamped and directed envelope, your MS. shall be returned to you. —HOLMDALE. Premising that 192,000 miles per second were spoken of as an erroneous measurement of the rate at which light travels, and that its actual velocity was given as 186,771 miles in a second, perhaps your difficulty will disappear if you reflect that light consists of undulations or vibrations in something which fills all space, and which is called the æther; and that it is not until such vibrations are transmitted to the retina that we see anything. Drop a stone into the middle of a large still lake, and a very appreciable interval will elapse before the tiny and ever-diminishing waves thus generated beat upon the shore, the stone having been, for the greater part of that interval, safe and sound at the bottom of the water. Suppose that the light from a fixed star occupies ten years in travelling to the earth. Then, quite obviously, if such an orb came into existence to-night, we could not possibly see it for ten years to come. After that, light would continue to reach us unintermittently as long as the star remained in existence; but we should, of course, see the star, not as it was at the instant we were regarding it, but as it was ten years before, when the light left it. For the same reason, were it annihilated, the light which left it at the instant of its disappearance, would reach our eyes ten years hence, so that we should continue to see it shining in the sky ten years after it had absolutely ceased to exist.—WAHRHEIT. The office of KNOWLEDGE is in Great Queen-street, London, W.C., and *not* in Queen Victoria-street, E.C., a totally different locality.—HALLYARDS complains that in letter 1626, p. 203, line six from the bottom, "firearms, language" appears, when he wrote "fire, arms, language," and that on the penultimate line "this subject" is printed for "their subject."—S.S. The details of precession and nutation scarcely admit of popularisation, but if any considerable number of our readers should express a wish for a popular general account of those phenomena, I shall be very glad to give it.—W. B. The "blessed Marchioness" of whom you speak as "capital padding" will disappear from these pages at the conclusion of the series of dialogues in which she is an interlocutor. No, neither "end of the wedge," either "thin" or thick. The lunatic you refer to sent me a publication which he edits, and that was my way of letting him down easily. If I *did* (as you allege) "dote on that personage," I must be in my dote-age, with a vengeance! Sorry that your "useful formula" was crowded out. Here it is: "A penny a day = £1 + £½ + either 5 or 6 pennies according as the year happens to be an ordinary one or a Leap Year." With reference to the paragraph which has elicited your approval, I only said what, I fancy, everybody else thought. You are mistaken in your supposition that I shall not insert what you tell me because I shan't believe it; for I shall insert it, and do believe it; a precisely similar case having come to my own knowledge. Hence, when you state that at the age of thirteen or fourteen, you distinctly saw Mars with the naked eye as a clearly-defined, red disc, without rays or any irregular irradiation, you are describing an uncommon, but by no means unique, occurrence.—W. GRAY. Delayed for several days, owing to your having addressed your letter to the *Editor* instead of to the publishers. The Editor has as much (or as little) to do with selling numbers of KNOWLEDGE as the Grand Llama of Thibet; there or thereabouts.—REV. LEONARD H. RUDD. You will note an excision in your letter as printed. To have reproduced the paragraph which I have struck out would have been to invite, with absolute certainty, rejoinders which, in common fairness, I could not have excluded; but which could only have initiated a discussion at once unprofitable and contrary to the frequently-expressed and absolutely inexorable rule which I have laid down, with reference to the subject you attempt to introduce.—HALLYARDS. Kindly read the reply which I have just written to Mr. Rudd.—E. NORRIS. I must reiterate, for the *n*th time, that KNOWLEDGE cannot be supplied, "free of charge," to any reading-room, club, library, or literary association whatsoever: an answer which I must ask ALFRED COTGREAVE to accept too.—NOVICE. The wind is said to "back" when it shifts in a direction against that of the sun's diurnal motion; for example, if it does so from S.W. through S. round to E. and N.E. It "veers" when it shifts with the sun, say from S.W. through W. to N. An anchor is "foul" when the cable gets twisted round it in any way. The third yards of a ship, counting upwards from the deck, are "top-gallant yards." "Courses" are the square sails next the deck, *i.e.*, the mainsail and foresail of a three-masted ship. A ship lying-to in a gale drifts a little, but practically does make no way.—G. H. DANN. I have delayed the acknowledgment of the receipt of your letter for a fortnight, expecting the arrival of the photograph which, you say, accompanied it. As I have seen nothing of this photograph, however, I think it is now quite time to tell you that it has never been delivered.

MESSRS. WALTER T. GLOVER & CO., of Manchester, have secured the contract for the wires and cables required this year by the Commissioners for the Lighting of the International Inventions Exhibition.

XUM

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (Knowledge being a popular magazine) than is accorded by the most excellent trade journals.

COMBINATION TOOL FOR GASFITTERS.

Fig. 1.

Fig. 2.

[Patent No. 2,123, 1884].—Mr. Plumpton has patented a combination tool useful as pliers and for a variety of other purposes. The central tool pictured in Fig. 1 is a pair of ordinary gas-pliers with the handles widened out to receive a solid screwing die as near the joint as possible. Square lugs on the die fit into corresponding holes in the handles, which again may be utilised upon the removal of the die for turning an ordinary tap or rymer. In the form shown in Fig. 2 the screwing-dies are carried upon V projections formed in the handles, and are pressed together by a screw in a cross-bar. The success which has attended the introduction of these pliers has induced the inventor to give still further attention to improving this class of tool, so as to render it more useful. The "outfit" now comprises screwing-stocks, dies, taps, rymer, tap-wrench, wire-cutter, gas and burner pliers, tube-cutter, and adjustable shaver, turnscrew, widener, centre-punch, &c., all in one article, the whole being fitted in a neat strong box suitable for being carried in the side-pocket.

KNIFE CLEANER.

[Patent No. 5,185. 1884.]—This is a simple piece of domestic apparatus patented by Mr. G. Pickett, of Cheapside, Grove-road, Eastbourne. It is called the Electric Knife Machine. The frame is made of iron, bronzed, with two polished turned blocks of wood covered with durable felt, the bottom block working on a pivot so as to adjust itself to any thickness of blade; prepared electric powder is placed on each pad. These pads are shut down, and the knife placed between them as shown. The left hand presses on the knob, while, with the right hand the knife is pushed forward and backward, a first-class polish being quickly produced. The bottom of the machine is so made that it cannot slip upon the table or dresser, and may, therefore, be kept close to the knife-box, so that, when the knives are brought dirty from the table, they may be immediately cleaned. It is claimed that a child can clean one dozen large or small knives in three or four minutes. The machine is likely to prove useful for picnic parties, as it takes up but little room and is always ready for use.

THE OPTIME LIGHTING SYSTEM.

[Patent No. 11,090. 1884.]—This invention, patented by Mr. J. H. Ross, of Dublin, has for its object the producing more perfect combustion in the burning of mineral or other oils, and of making them more applicable and more easily adapted as a means of either public or private lighting. Rock oil, for which this system has been principally adapted, is the cheapest oil that can be used for illuminating purposes. It is practically non-explosive, and free from sulphurous or ammoniacal impurities. The absolute freedom from danger of explosion, as well as the cheapness of the light produced from it, renders it more suitable as a means of lighting than oil gas, which is produced by mixing the atmospheric air with the vapour of gasoline. Gasoline is explosive at 60° Fahr., the danger incurred in transit rendering it unobtainable, except in the largest towns, while rock oil can be obtained in the smallest village. The Optime system consists in forcing a current of atmospheric air through ordinary gas-pipes and fittings to any number of lights, according to the size of machine used. This air-current, by impinging on the flame as it passes through the burner, produces a pure, white, soft light, free from smoke, heat, or smell, nor does it flicker like a gas-flame. In a sanitary point of view this system is claimed to be the most perfect, the air-current being conducted to the lights from outside the apartment, or building, and therefore not consuming the air in the apartment, as is the case with all other systems (Incandescent Electric-light excepted). It is estimated that the cost of lighting on this system is about half that involved when gas, at the rate of 3s. 9d. per 1,000 cubic feet, is consumed.

In the United States, 18,799 patents were granted in 1884, of which 1,166 were for electric inventions.

The central electric-lighting station of Colchester made a loss of £1,818 last year.

The Simplon.—It is proposed to carry a railway through the Simplon. The Paris, Lyons, and Mediterranean Railway Company will contribute £1,600,000 to the project. Italy will complete the approaches.

A *Times* telegram states that the national revenue of the United States for the eight months ending in February, shows a decline of 13,000,000 dols. in customs, and one of 5,000,000 dols. in inland revenue, while the expenditure has increased by more than 3,000,000 dols.

A bridge, carrying the Northern Pacific across the St. Louis Bay, between Daluth and Superior, will, when completed, be one of the largest railroad bridges in the North-west of America. It will be nearly one mile in length, and will be composed of three sections. The draw will be 246 ft. long, the fixed truss span 160 ft., and the pile-bridging 4,290 ft., making the total length 4,696 ft.

Our Chess Column.

By MEPHISTO.

PROBLEM No. 151.

By J. S. McKEAN.

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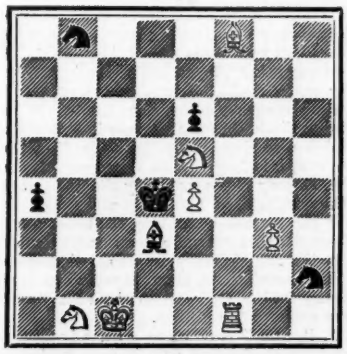

WHITE.

White to play and mate in three moves.

THE CENTRE GAMBIT AND GENERAL PRINCIPLES OF DEVELOPMENT.

1. P to K4 / P to K4 2. P to Q4 / P × P 3. Q × P / Q Kt to B3 4. Q to K3.

This variation of the centre gambit leads to a steady game. White has already made two moves with his Queen, bringing her into play rather early, but this loss of time is equalised by Black's inability to play his KB to B4. It would not be safe for Black to play 4. B to Kt5 (ch) followed on P covering by 5. B to R4. (We have often stated before that in games where the KB is prevented from playing to B4 he is best posted on K2, as otherwise the K's side becomes weak.) White, after 5. B to R4, would play 6. Q to Kt3, compelling Black to play either 6. Q to B3 or P to KKt3 or K to B sq., all of which would result in weakening Black's position. Dismissing, therefore, 4 B to Kt5 (ch) for Black, there remains 4. P to QKt3, with a view to playing B to B4, also 4. P to KKt3. But there are objections to be urged against both these moves. 4. P to QKt3 is only a preparatory move against which White developes a piece, presumably the QKt, with the possibility of playing Q to KKt3 in conjunction with Kt to Q5. Furthermore, the P on Kt3 blocks the Black B, which later in the game might prove inconvenient for Black; moreover, 4. P to QKt3 in a measure restricts Black from playing his Q's P, on account of the QKt being exposed to the pinning action of the White KB either on QKt5 or Q5. Any of these as yet merely prospective disadvantages may, in course of play, assume definite shape. For that reason the move is opposed to the modern theory of development, according to which every piece brought into play constitutes a gain of time.

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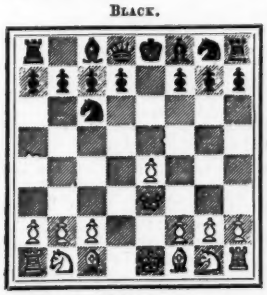


WHITE.

In reply to 4. P to KKt3 White would play 5. B to Q2, B to Kt2. 6. B to B3, and we do not see any particularly bright prospects for Black's game.

These constrained defences lead to no definite result and produce dull games, wherein Black has to fight hard, having the disadvantage of a cramped position.

Far better than any of these moves is the reply analysed by Berger, 4. KKt to B3. Of course, as before stated, the only excuse for deploying the White Queen so early in the opening, is that Black's development is thereby prevented. But, if in spite of anything, Black can avoid such damaging moves as P to QKt3 or KKt3, and succeeds in bringing out his pieces, then the moves of the Queen will virtually be transformed into loss of time for White; moreover, the Queen will be liable to the further attack of the minor pieces.

4. Kt to B3 was not considered good, on account of White's reply of 5. P to K5, Kt to Kt5. 6. Q to K4 or K2, placing the Black KKt somewhat in an awkward position, not being able to take the White KP on account of P to KB4 winning a piece. According to Berger, however, this objection does not hold good, as the following analysis will show, which likewise will serve as a good example of the value of proper modern development, *e.g.*:—

4. Kt to B3
5. P to K5

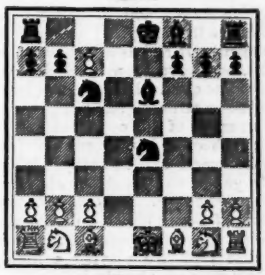
After having disposed of this move (the only objection to Kt to B3), we shall deal with other moves at White's disposal.

5. KKt to Kt5

If Kt to Q5, 6. Q to K4, then either Kt to K2 or Kt to Kt3 is favourable to White's development.

6. Q to K4 or (*a*)	P to Q4!
7. P × P (ch)	B to K3
8. P × P	Q to Q8 (ch)
9. K × Q	Kt × P (ch)
10. K to K sq.	Kt × Q

BLACK.



WHITE.

Now it will be seen Black has quite frustrated White's attacking designs, he has almost all his pieces in good play, is enabled to castle, and may capture at his leisure the P on QB7, remaining with a better position for the end game. Black now threatens KB to B4 or B to Q3. If, to prevent either, White plays 11. B to Q3, then Kt to B4, threatening to isolate the QP by capturing the B, will gain further time for Black.

(*a*) On his 6th move, instead of Q to K4, White might have played different, *e.g.*,

6. Q to K2

To this Black replies with

6	P to Q3
7. P × P (ch) or (*b*)	B to K3
8. P × P	Q × P

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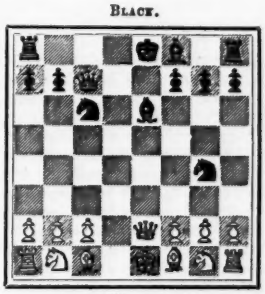

WHITE.

As will be seen from the annexed position, although being a P behind, Black has a very fine game, his immediate intention being either Kt to Q5 or KB to B4 or Castles QR, when his attack will become very strong.

(*b*) White, however, on the 7th move may refuse to take the proffered Pawn. Instead of 7. P × P (ch) White might play

7. P to KR3

Of course if 7. KKt to B3 or 7. B to B4, then KKt × P follows.

	KKt × P
8. P to KB4	Kt to Q5
9. Q to K4	Q to R5 (ch)
10. K to Q sq.	Q to B7!

with much the better game.

(To be continued.)

SOLUTION OF END GAME, p. 206.

Position.—White: K on KR sq., Q on QR3. Black: K on KB8, P on K7.

1. Q to B8 (ch), K to K8. 2. Q to Q6, K to B7. 3. Q to B4 (ch) K to K8. 4. Q to Q4, K to B8. 5. Q to Kt sq. (ch) mate.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Q. T. V.—On advancing a Pawn to the eighth square, a player may choose any piece he likes. Thus, he may have a third Knight, Bishop, or Rook. We only objected to the nonsensical rule of being allowed to change the advanced Pawn to a piece of the opposite colour.

EDW. CARTER.—Problem and game received, with thanks.

BILBAO, EDW. CARTER.—Why do you suppose that in the End Game, p. 206, on White playing 1. Q to Kt3, Black is compelled to Queen the Pawn? Would not a Knight do as well?

SQUIRE.—In Problem 150, if K × B, the R checks, and there is no mate.

Correct Solutions received:—End Game: H. A. N. Problem 150: H. A. N., Uncle John, W., Ravenshoe, Emma Coope.

XUM

Our Whist Column.

By Five of Clubs.

OPENING THE PLAY.*

THERE is a noteworthy difference between the views which the Whist-player, the player of home Whist, and the player of Bumblepuppy take respecting their hands as they arrange them after the deal. In the earliest stage of practice the player looks on the Aces in his hand as so many almost certain tricks; he expects to make his Kings; and he hopes for his Queens. His small cards he regards as worthless, as cards, which he simply has to throw away to the enemy's winning cards. If he has a two-card suit, and still better if he has a singleton, then his small trumps will serve him in ruffing—the only use for small cards known to him. He has little anxiety lest his trumps should be drawn; for an early trump lead is unheard of in this innocent incipient (and insipient) Whist. Therefore he plays his Aces first; his Kings after the enemy (equally childlike in their play) have gotten rid of their Aces; and later his Queens. If he has a singleton, he plays that immediately after his Aces have been utilised. He expects his partner to return his lead at once. If the enemy have led a suit of which he has the best card or cards, he hastens to make these, having no idea of keeping command of his opponents' suits. When he has to discard he always chooses his longest suit, as being the one from which he has most small cards to play. When every one at the table plays this game, the result is about as amusing as any game of pure chance can be. This game is not Bumblepuppy, but the ancient form of home Whist, a dreary and monotonous pursuit, the chief interest of which seems to reside in the idea of those engaged in it that they are playing a highly scientific game. Very little scolding goes on at this dull game—unless the players are naturally ill-tempered—the only mistake one can make in it being the revoke.

Bumblepuppy is a more pretentious game altogether. In it the players are possessed with the idea that they know something about Whist. They smile at home Whist, which is innocent compared with their noxious system. The Bumblepuppist imagines he is a brilliant player. He rejects conventional rules as not binding on a Whist genius such as he supposes himself to be. Thus he views his hand neither like the true Whist-player nor like the player of home Whist. It is true he always leads a singleton if he has one—no Whist duffer can escape *that*. But he often leads trumps early—especially if he has only one or two. His smile of triumph at the enemy when, on the return of the suit by his partner, two trumps fall for one is worth noticing. Nor does it disappear if (as commonly happens in such cases) the enemy are left, one with established trumps, the other with odd trumps for ruffing. This he regards as a mere accident. The cases, though only one-third of the total number, in which his partner turns out to have the longest trump-hand, he regards as the normal ones, and his own brilliancy as throwing into his partner's hand the power of using such trump strength. The Bumblepuppist is also very fond of signalling, and very indignant when his partner, having learned his ways, pays no attention to his signals. The Bumblepuppist does not lead out Aces, as the home Whist-player does. He is, indeed, apt to keep them back rather too long. But, like the player of domestic Whist, he has no notion whatever of the necessity of keeping command of his opponents' suits.

The Whist-player takes a very different view of his hand, and of the way to utilise such elements of strength as it may possess. In the first place, he considers whether the hand promises to take the leading part in the play,—that is, whether he can safely suggest to his partner the propriety of playing chiefly in his support. If he has good strength in trumps, a long and strong suit and a good card or two in the other suits, the chances are that he will do well to play a forward game. If he has good strength in trumps, but no good plain suit, he may still have to take a leading part, by endeavouring to get command in trumps, and then helping all he can to bring in a strong suit of his partner's. But for this he must wait until he has had evidence that his partner has a strong and long suit. If he has neither strength in trumps nor a good suit, he may have such command in the plain suits as to be able to sustain a strong defensive game against the enemy, and perhaps to help his partner effectively to take the lead. Even though he have good cards in but one plain suit, and that not a long suit, still the whole game may turn on his defence of that suit against the enemy. Lastly, if he has utter weakness, insomuch that he can barely make a single trick, or may even fail to make a trick, he may yet by careful play escape the disastrous results which must follow—in such a case—from suffering the enemy to imagine his weakness.

It will be manifest from a consideration of the different positions here suggested that the original lead is only an advantage with a strong hand, when even though partner be weak a forward game may still be played. With a weak hand it is an advantage to be second or fourth in hand, where the play of a low card does not necessarily indicate abject weakness.

But while the lead is a disadvantage to the holder of a weak hand, I do not think that any difficulty ought as a rule to be experienced as to the original lead even from the weakest hand. In the case of the first lead of any other player but the original leader, there is often room for much doubt, because such a player already knows something of the strength of the various hands. If he is weak and has seen reason to think that his partner is also weak, he ought at once, in my opinion, to give up the idea of leading from his longest suit merely because it is long. With very great weakness he ought even, as double-dummy play repeatedly shows, to give up the idea of retaining the command of his opponents' suits. By so doing he is likely to lose the chance of making the tricks necessary to save the game. How often do we see a commanding card kept back in subservience to the rule (usually excellent) that command should be kept over the enemy's suits, then played when it can be ruffed, and the command falling after all to the enemy while a trick has been lost in the attempt to retain it.

But while *Y*, *B*, and *Z* may often with advantage disobey the rule of leading from the longest suit, it very seldom happens that *A* should do so. Supposing even such an extreme case as that *A* holds Ace, King, Queen in each of the plain suits, and 2, 3, 4, 5 in the third, with three small trumps, what does he lose by leading from his extremely weak long suit or gain by leading from one or other, necessarily chosen at random, of the two tierces major? He may seriously compromise the game by leading out the three cards of either strong short suit; for he may leave one of the enemy with several long cards of the suit, to be perhaps brought in by a re-entering card in the long weak suit. Now, by leading from this weak suit you give your partner a fair chance of making a trick in your suit, and showing his, in which you can give him good support, showing him by so doing that your own suit is too weak to be worth continuing. The real doubt would be whether the best trump should not be led; and in so extreme a case, with such utter weakness in the long suit, and such strong command of the other plain suits, this would doubtless be the best course.

I lay down as a sound general principle that the original first lead should be almost always from the longest suit—unless that suit be trumps, when the best of the strong suits should be opened if an original trump lead is unsuitable. But note that if you lead from a long, weak suit with weak trumps, and no re-entering cards in the other plain suits, you do this merely because such a course is least likely to hurt your partner. You are simply powerless to make anything out of your own hand. When you are not original leader, it is generally better in such a case to lead the suit which seems most likely to help your partner.

* From a series of articles on Whist, in the *New York Tribune*.

"I may note down as a remarkable fact, that this evening (Oct. 31, 1850) I played ten rubbers of Whist and lost them all, and, moreover, never once cut to win the deal. In all, have lost since I came here 197 points."—*Mr. Greville's Diary*, p. 365.

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